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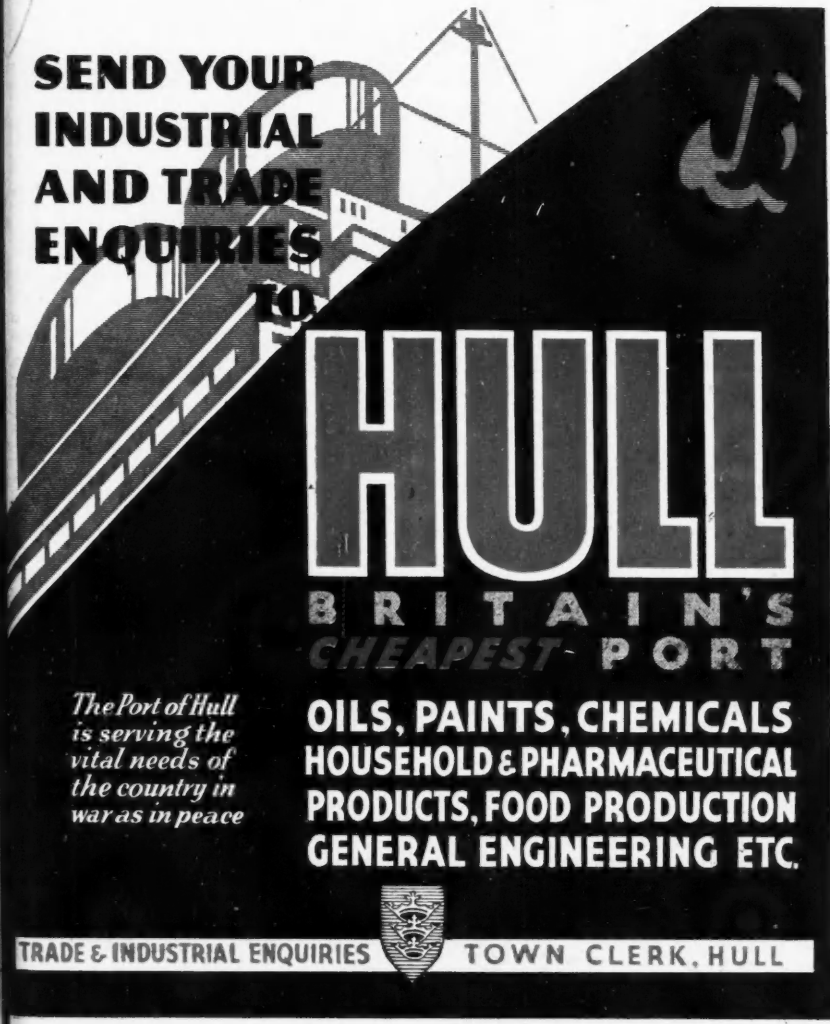
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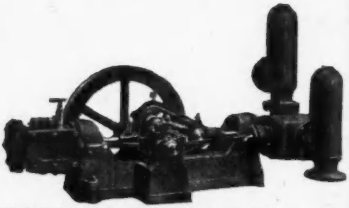

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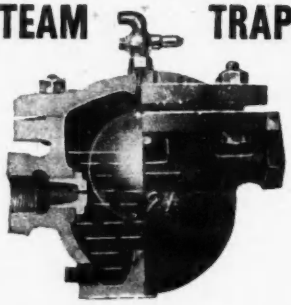

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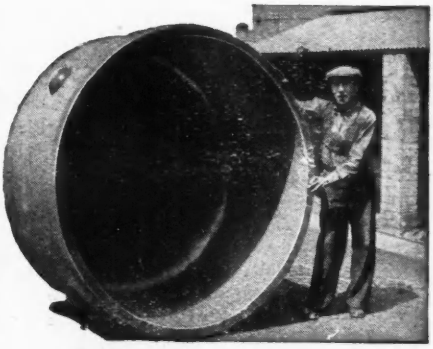

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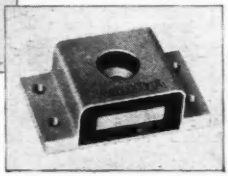

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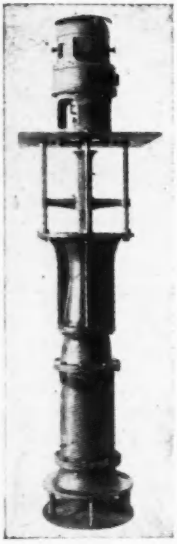

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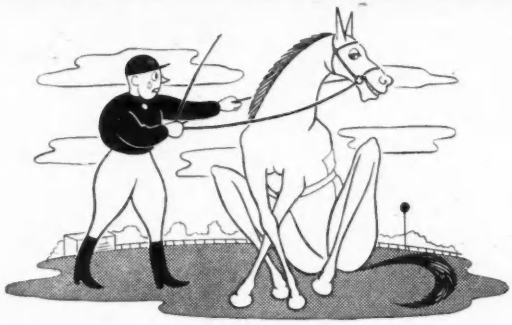

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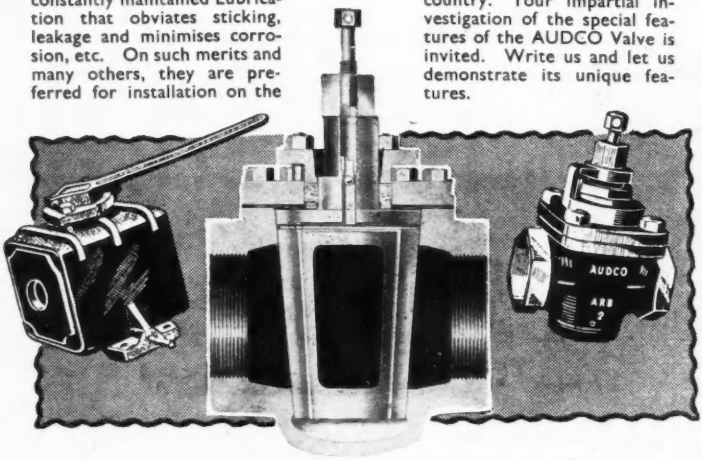

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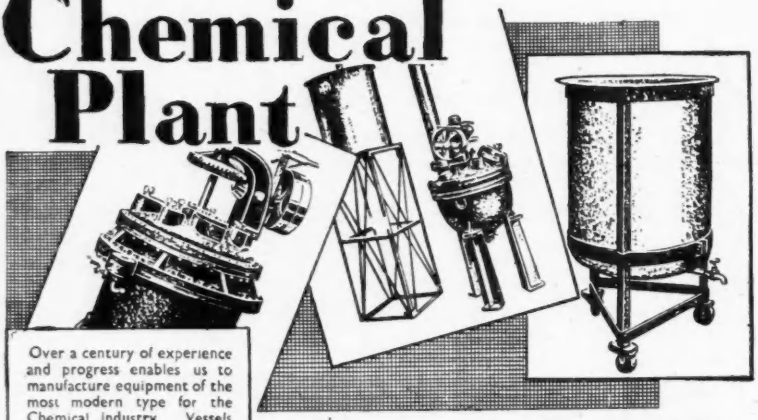

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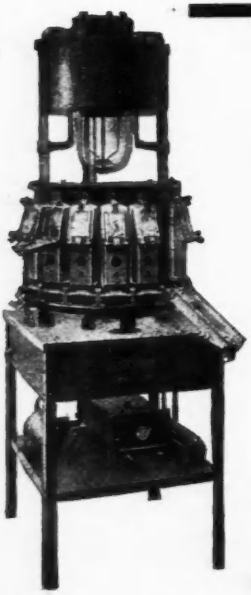

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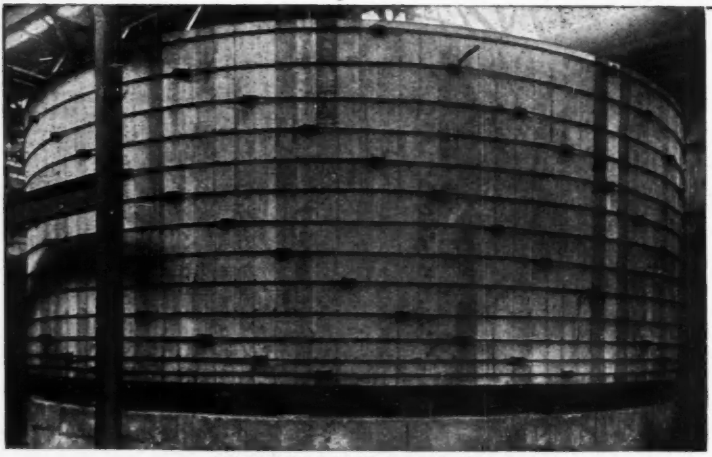

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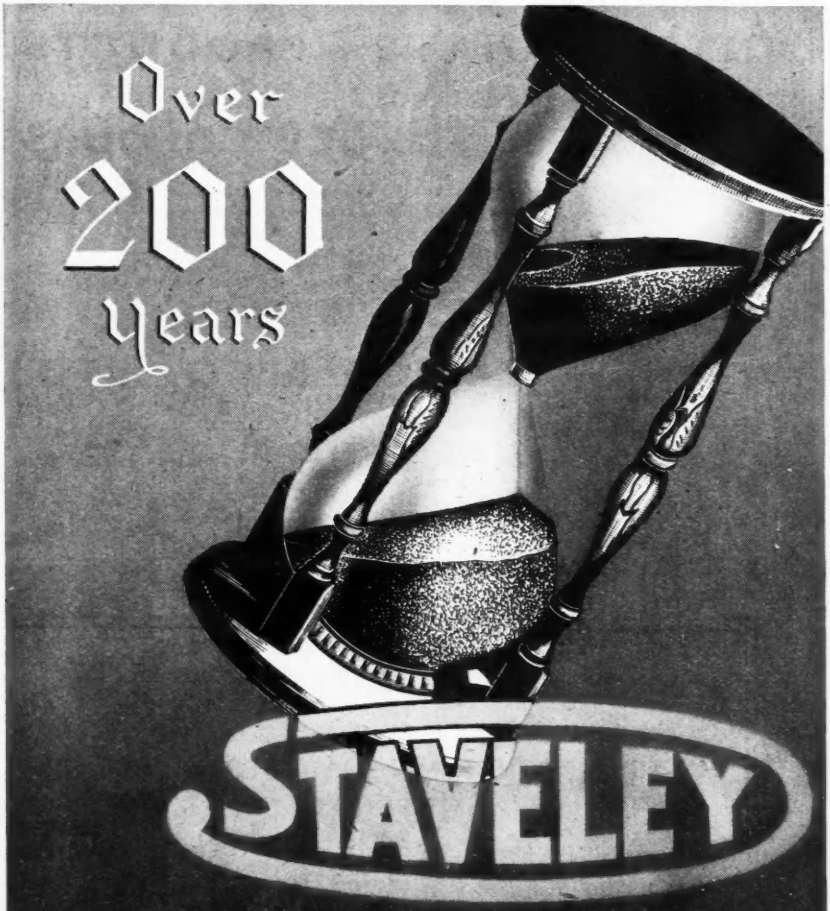

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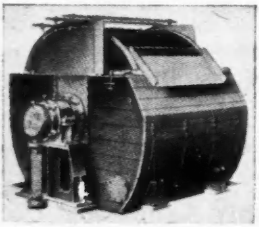

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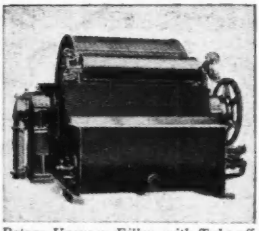

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No. 1224

December 12, 1942

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Accessories Before and After

FOR the readers of murder stories there are two kinds of accessories, those "before the fact" and those "after the fact"; but for the chemical engineer and chemical manufacturer accessories to plant are permanent and omnipresent. But they can be connected with "crime," industrially speaking, just as much as their namesakes in detective fiction. Any of our readers who have had the patience to study the "safety first" articles which appear from time to time in our pages cannot fail to have been impressed with the number of occasions on which faulty accessories have led to the injury, and even death, of the chemical workers who had to deal with them. Such carelessness in the good maintenance of plant accessories is punished, under the terms of the Factory Acts, by good round fines, but it is a credit to the British chemical industry that the type of carelessness which amounts to criminal negligence is practically unheard of. Precautions and safety measures are almost always well observed; but even Homer nods, and there is no harm in taking steps that might be described as "pre-precautions."

The first and most important of these preliminary measures is the selection of accessories suited to the type of plant involved. An article further on in this issue deals with this point and covers a wide field of the innumerable types of accessory which are essential to the smooth working of chemical plant. It is an unending study, for, with the march of science, the number of possible and desirable accessories available is growing day by day. The advertisement pages of this and every other trade and technical journal contain plant manufacturers' suggestions and indications of the purpose for which their products may be used. It is all very well to be cynical about "business" and "publicity," but it does a manufacturer very little good to see his product bought and used for a purpose to which it was not designed; an accident may follow and the product will be blamed—when all the time the fault may have lain with the purchaser who failed to specify his precise needs to the manufacturer.

Plant buyers should certainly co-operate with plant makers; indeed the makers should insist on this co-operation for their own protection. Failure or accident, of which the immediate cause was a wrongly selected accessory, must redound

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to the discredit of that accessory and ultimately do harm to the manufacturer thereof. We would go so far as to say that it is better to turn away a pig-headed purchaser empty-handed rather than supply him with an article which is not specially intended for his purpose. We hope that such a situation could not arise, and that there are no potential purchasers sufficiently pig-headed to ignore the advice of their suppliers; but it is impossible to be certain, especially in these days when circumstances have forced some of us into situations where we must handle material with which we are not fully conversant. War conditions may have changed, or at least extended, our jobs; let us be sure that our habit of mind has correspondingly broadened.

The second precaution that should be taken before plant accessories are chosen is almost too obvious to need comment; it is to ascertain that the article is of unimpeachable quality. Everyone, it will be said, does this as a matter of course. In normal circumstances, certainly; but is this equally true in these days when conditions are abnormal, time presses, regular suppliers are unable to help, and new substitutes are appearing daily? It does not seem unreasonable to suggest, at any rate, that the point should be observed with extra care. Fortunately, most types of accessory feature are manufactured by more than one firm of equal merit, and when the regular supplier fails, through no fault of his own, there can be no harm in consulting the announcements of others of the trade, preferably in the pages of a reputable journal. Competition, in the peace-time sense, has gone by the board; the job *must* be finished, and finished to time.

A leading article is not the place to enumerate the various kinds of precaution that must be taken with the accessory features of plant when once they have actually come into operation on the plant. Regularly every month for some time past, we have indicated some of the hazards involved in the misuse or careless use of chemicals and chemical plant of all types, and the part played by accessory features in this respect has not been forgotten. It may well be recalled here, however, that plant accessories often have to withstand severer conditions of usage than does the plant itself—often they are the only moving parts in an otherwise stationary piece of mechanism, or their nature or size limits the weight or thickness of the material of which they are constructed. Again, in these days of "conservation of critical material," necessity may arise for the use of reconditioned plant—once more an opportunity for special care with accessory features, which may even require replacement or re-positioning (say, in the case of automatic indicators) when the main part of the plant will serve very well as it is.

Fortunately, the makers of accessory features of plant, whether it be a heavy-duty pump or a tiny recording instrument, are fully aware of the difficulty of present day conditions, and have acted accordingly. More than ever, therefore, it should be insisted that manufacturer and purchaser get together to ensure that every accessory feature in use shall be of the best possible material and the most appropriate type.

NOTES AND COMMENTS

Improvisation

PROBABLY nowhere better than in the chemical industries is there a really fine chance to make use of the talent for improvisation, which is supposed to be an essential part of the British character. In many cases, "improvisation" is simply a polite way of describing the faculty of getting somehow or other out of a mess of one's own making; but in the chemical industries it is fair to say that the improvisation used is the genuine article. In studying the would-be helpful words in the leading article above, we have been struck by the fact that they are all very well in their way—but what happens when you simply cannot get the particular type of plant accessory that you are looking for? We consulted one or two of the most knowledgeable men in the chemical plant industry, and their verdict was that you just don't get it, or at the best, you have to wait a very long while until it becomes available—and meanwhile you have to improvise. Our sage advisers uttered, among other things, the dread word "priorities." For certain sections of

the chemical industry, of course, the notion of priorities holds no terrors, but not every user of chemical plant, even to-day, is engaged on work of national importance in the strict sense, and those who are not have to wait their turn. Meanwhile it is always worth while to consider alternative methods, and that is where the gift for improvisation can come in. It may mean a certain amount of experimentation, but that should not present an insurmountable obstacle to the enthusiastic chemist; and it should be remembered that more than one cardinal discovery in chemical practice has had as its source some makeshift measure.

Allied Scientists Meet

A FURTHER step was taken recently towards the close co-operation of scientists with those who are more directly concerned with the prosecution of the war, when scientific workers from countries menaced or oppressed by Nazi Germany and her allies, assembled in a conference in London. They pledged themselves to answer each new crime with a further intensification of their efforts on behalf of the suffering peoples of the world by striking harder at the enemy. They expressed satisfaction that a very considerable number of foreign scientific workers had already found work in this country which enabled them to use all their knowledge and training in the common war effort. Sir Richard Gregory, President of the British Association for the Advancement of Science, presided. Sir Richard said that the Association of Scientific Workers which, with the support of the British Association, organised the conference, was fortunate in having as its president Sir Robert Watson Watt, whose researches had resulted in the striking achievements of radiolocation.

Opportunity for Co-operation

DR. G. LEWI, of Czechoslovakia, spoke on "Scientists and the Administration of the State." He said that to-day in Britain we had many scientists and technicians of the allied nations. This was an opportunity which offered to the scientific bodies of Great Britain and the U.S.A., and also the U.S.S.R., greater possibilities for co-operative relations than at any time before. It was for the scientists of the allied nations to create a sincere and intensive co-operation in connection with the urgent problems relating not only to this war, but also to those of post-war reconstruction. The associations of scientists and technicians of allied countries now in this country had, he said, found many of the British societies very helpful in making available the facilities of their libraries, extending associate fellowships, and so on. Scientists from other allied countries contributed their assurances of full co-operation, one of the most significant points being made by Dr. J. Kuczynski, who spoke for the Scientific Section of the Free German League of Culture. One must not forget, he said, that there are some scientists at least in Germany who are actively engaged in the fight against Hitler. Sir John Russell, Director of the Rothamsted Experimental Station, dealing with matters nearer home, said that with modern diet we could grow two-thirds of our food in Britain.

"Brains Trust for Every Industry"

THE suggestion that the gas industry should institute its own technocracy or brains trust, consisting of a full-time panel of experts in chemistry, engineering, accountancy, and so on, was made by Mr. G. L. Braidwood, M.Inst.Gas E. in a paper presented last week to the Southern Association of Gas Engineers and Managers. Research, to-day, he said, is a prime necessity for the progress of industry. In the past, full use had not been made of scientific knowledge—the same complaint had been made by Professor A. V. Hill concerning the country's war effort. This might sometimes be because new inventions would cheapen consumer's goods and so diminish the producer's profits—if it did not actually drive him out of business; but it was more often due to lack of enterprise and co-ordination. Some of the world's great inventions, said Mr. Braidwood, had been discovered by accident, but the rapid advance of technology had turned the world in which we live into a highly developed industrial machine, and research was no longer something that could be left to enthusiastic amateurs improvising in back sheds. Every industry should have a central research organisation to which the various units should contribute in both cash and experience.

Underground Gasification

MR. BRAIDWOOD'S paper is likely to cause some notable reaction not only in the gas industry, but in other similar enterprises. It may be considered a realistic approach to the whole question of securing for an industry a fitting place in a post-war world which many believe will be far different from that which existed before the present war; or it will be attacked as distinctly revolutionary in its advocacy of more control over industrial affairs. Mr. Braidwood thought it certain that in some instances central organisation could effect considerable economies and provide better service, but it depended, among other things, on the main type of occupation of the people, and the distance from the source of raw material supply. For instance, where it was desirable for coal to be treated and gas distributed from near the pit-head, the underground gasification of coal seemed to hold great possibilities. He felt that there was probably much to be learnt from that revolutionary process with its use of liquid oxygen, development of the gas turbine, and evolution of synthetic liquid fuel and chemical products.

The Synchrophone

TELEVISION, with its enormous educative and entertainment possibilities is no longer with us, but a new method of industrial training has been recorded which bears a relation to television similar to that between the magic-lantern and the cinema. This is the system of training by "synchrophone," a gramophone-plus-picture method, described in the current issue of *Industrial Welfare and Personnel Management*, the organ of the Industrial Welfare Society. The synchrophone comprises two instruments, one telling the story and the other providing a picture. Lectures are recorded on ordinary 12-inch gramophone discs. As the lectures proceed from the sound unit, appropriate parts of the picture are thrown out in brilliant stereoscopic relief. For example, the illustration may be a section of some complicated mechanism. As each component is mentioned by the lecturer it lights up so that it stands out from the rest, but can still be seen in relation to the whole. An adaption of the principle to the chemical laboratory would be interesting, and, in the case of some experiments, could be really striking. An obvious advantage of the system is that the lectures or explanations can be given in any language, a specially valuable point in countries where there is a lack of skilled teachers.

The Language of Science

LANGUAGE is a matter of first importance to the industrial chemist. If the lack of equipment of the young scientist for self-expression in his own language is causing pain to the more articulate older generation, it is no less a matter for regret that study of the work of men in other countries is hampered by linguistic limitations. "Searching the literature" is a profitable and, to some, a fascinating occupation. There are, of course, translations of the more important works, but the pleasure of consuming a proffered dish of this sort is not to be compared with that of searching out new food for thought among the extensive fare on the table of international science. The study of languages to a degree of proficiency which will enable the student to read foreign scientific works is a long and arduous task, particularly in these days when there are so many competing demands on his time.

International Need

FORTUNATELY, however, there is another way. The question of an international language is not new. It is a half-truth about some chemists to say that they already have such a language. But the need for a sound international currency for ideas is being given more serious attention than ever before. Sir Richard Gregory, President of the British Association, has gone so far as to say that an international language will be one of the most important of post-war needs, and has expressed a hope that academic as well as scientific and commercial organisations will assist in the movement towards an agreed auxiliary language. He did not, according to the report of his address, indicate what form such a language should take, and there are several systems already in existence. It might be said, however, that Basic English has, perhaps, aroused more interest among scientists in recent years than any other form.

Steam Traps for Chemical Processes

Factors Governing Selection to Attain Fuel Efficiency

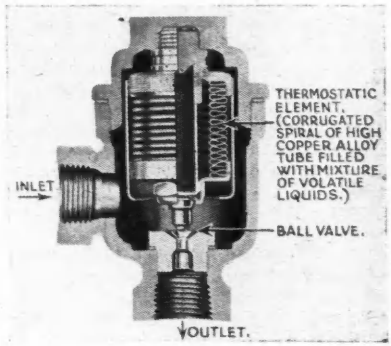
by D. D. HOWAT, B.Sc., Ph.D., A.I.C., A.Inst.M.M.

IN any steam apparatus where water of condensation forming or lodging in the vessel would impair steam or heating efficiency, drainage gear is essential. A drilled plug-cock or manually operated valve may be employed to drain off condensate from pipes, drying cylinders, and evaporating basins. For efficient working the cock or valve must be operated by hand in such a way that condensate drains away just as fast as it forms, the amount forming being dependent on the output, pressure, and temperature in the vessel. Such accuracy of control is extremely difficult, if not impossible, even with highly skilled operators. But unless very close control is exercised, steam and heating efficiency deteriorate either by reduction of the efficiency of heat transfer owing to retention of condensate in the vessel, or by loss of live steam.

These difficulties may be largely eliminated by fitting a type of steam trap. The requirements of the ideal steam trap may be stated as follows:

(a) Automatic discharge of condensate without loss of live steam.
(b) Automatic discharge of air from vessels and pipes during starting-up operations.
(c) Economy and reliability in operation.
(d) Ability to handle easily fluctuating condensate loads.
(e) Ability to operate with wide variations in steam pressure.
(f) Positive and direct-action closing without wire-drawing.
(g) Ease of access to working parts without disconnecting pipes and fittings.
(h) Robust mechanisms resisting water-hammer and corrosive condensates.

No single steam-trap possesses all the qualities noted above, varying types being designed to meet the varying conditions obtaining in chemical industry. The study of operating conditions should guide selection of the type best suited for the immediate purpose. Traps may be divided into the main categories as follows: (1) *Expansion or Thermostatic Types.* Here the valve for the discharge of condensate is operated by a thermostatic element, the movement of which is controlled by the temperature difference between live steam and condensate. (2) *Float or Mechanical Types.* In these the valve for the discharge of condensate is operated by a float or "bracket," the movement of which is controlled by the volume of condensate in the trap. Traps of the first type may be subdivided into the following groups: (a) *Balanced Pressure Traps*; (b) *Liquid Expansion Traps*; (c) *Metal Expansion Traps.*


THERMOSTATIC ELEMENT. (CORRUGATED SPIRAL OF HIGH COPPER ALLOY TUBE FILLED WITH MIXTURE OF VOLATILE LIQUIDS.)
INLET
BALL VALVE.
OUTLET.

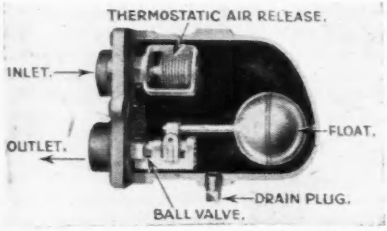
[By courtesy of Spirax Mfg. Co., Ltd.

Fig. 1. Balanced pressure thermostatic trap, suitable for pressures up to 200 lb.

Balanced Pressure Traps comprise a thermostatic unit, frequently made of flexible tubing bent into a spiral and filled with a volatile liquid or mixture of liquids. One end of the thermostatic element is anchored firmly, while the other, to which the valve is attached, is free to move. When steam reaches the thermostatic element the volatile liquid boils, the increased pressure extending the flexible tubing and forcing the ball valve down on its seat. When the condensate surrounding the thermostatic element cools to about 4° C. lower than the steam temperature (the operating point) the reduction in pressure inside the element causes the spiral tubing to

contract, pulling the ball valve off its seating and so discharging the accumulated condensate. The trap will therefore function at almost any steam pressure, as the operating factor is the difference in temperature between the steam and the condensate. The volatile liquid in the thermostatic element is so chosen that each degree corresponds to the same variation in the internal pressure. This is the reason for describing these as "balanced pressure thermostatic traps." (Fig. 1).

The advantages of this type of trap are: (a) The traps though small in size have a large discharge capacity. (b) The valve is always open when the trap is cold, so that automatic discharge of air is effected. (c) Freezing when cold is eliminated as the trap is open and free of water unless, through faulty pipe design, condensate may drain back from a rise in the discharge pipe. (d) Maintenance costs are low. Thermostatic elements must be replaced at intervals of twelve to twenty-four months. Replacement time is short and the cost of new elements is small. The disadvantages of this trap are: (a) The condensate must cool to 4° C. below the steam temperature, so that a certain time-lag occurs in the discharge of condensate and a certain loss of heat units by radiation from the trap is necessarily incurred.



[By courtesy of Spirax Mfg. Co., Ltd.

Fig. 2. Float trap suitable for pressures up to 120 lb.

(b) The flexible thermostatic element will not withstand water-hammer of the action of corrosive condensate. (c) With high steam pressures the trap gives rise to a blast discharge. (d) Owing to the excessively high internal pressures generated in the thermostatic element by the high temperature, these traps should not be employed on super-heated steam lines.

Liquid Expansion Traps. The condensate discharge valve is controlled by a ball carried on the end of a steel piston. The piston, housed within a sealed cylinder full of oil, is connected to one end of the cylinder by a corrugated tube capable of compression or expansion. This flexible tube forms a packless gland between the piston and the cylinder. When steam reaches the cylinder of the trap, the increased oil pressure in the cylinder, acting on the top of the piston, causes it to move outward, restricting the aperture of the discharge valve. If, owing to large flow of steam, the pressure rises further the valve closes completely. Normally it functions as a continuous discharge trap. The traps are adjustable and may be set to close off at a given temperature. Normally the temperature of condensate discharge is 100° C. Claims are made for this type of trap that: (a) It may be used on superheated steam and with pressures up to 275 lb./sq. in. The valve is set to close at a certain condensate temperature so that the high-temperature steam is kept away from actual contact with the trap. (b) When the trap is cold the valve is open, therefore air is easily displaced and the trap will not freeze. (c) The trap, operating usually as a continuous discharge, functions quietly and without blast. (d) The trap is unaffected by water-hammer. Offsetting these claims are the following disadvantages: (a) Designed to function as a continuous discharge trap, the valve opening is not large and a by-pass is necessary to handle severe load fluctuations. (b) The trap does not function easily with fluctuating steam pressures and loads. (c) Corrosive condensate will attack the packless gland. (d) If condensate is being discharged at a low temperature space must be provided for collection, a collecting leg with a minimum length of 12 feet being recommended.

Metal Expansion Traps are of all-metal construction, the condensate discharge being controlled by a solid-drawn tube seating on a conical valve. The action of the trap depends on the difference in expansion between an outer tube of wrought iron or steel and the inner solid drawn tube, made of "Invar" steel or brass. The salient features of this type are: (a) Easy adjustment; the conical valve is carried in the outlet connection which is locked into any given

position by a lock-nut. (b) Robustness; the traps are not affected by water-hammer. (c) Corrosion resistance; if suitable metal alloys are chosen, very severely corrosive condensates may be handled. (d) Air discharge; it is open when cold, ensuring discharge of air and preventing freezing. Against these it must be admitted that: (a) The traps are not flexible, a defect they share with the liquid expansion type, and will not handle severely fluctuating pressures or loads. (b) As the difference in coefficient of expansion between the two metals is small the trap must be made long to give a practicable movement at the discharging valve. A common commercial type is 40 inches in length.

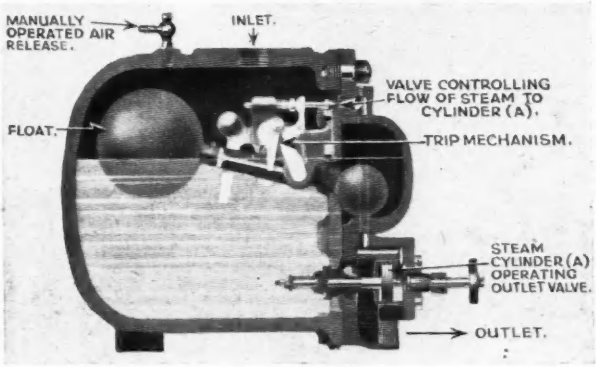


Fig. 3. Steam-operated float trap, suitable for pressures up to 500 lb.

[By courtesy of U.S. Metallic Packing Co., Ltd.

Float or Mechanical Traps

A simple float trap comprises a hollow float connected to a bell crank lever which engages with a slot in a horizontal slide with a domed end. This end engages with the seating on top of the condensate discharge pipe. As the float lifts with accumulation of condensate the valve is opened wider to facilitate more rapid discharge. When the trap is cold the valve is closed and special provision must be made to allow the escape of air. In Spirax traps this takes the form of a small thermostatic element located near the top of the float chamber, the valve being connected by a short passage with the main discharge pipe. This thermostatic element opens the valve when the trap is cold allowing rapid discharge of air. (Fig. 2).

The simple type of float trap, as described, is liable to suffer from wire-drawing of the discharge, with consequent loss of steam and wear of valve seating. To obviate this defect, the Bradford Steam Trap, manufactured by the United States Metallic Packing Co., Ltd., is designed so that the float does not act directly on the valve, but releases or engages a weighted lever so arranged that the outlet is very rapidly opened or closed. The trap is produced in two modifications, the piston-operated and direct-operated types. In the piston-operated trap the discharge valve is operated by the steam acting on a piston working in a cylinder. Steam is admitted to the cylinder through a needle valve, the movement of which is controlled by the weighted lever. With this device a large orifice discharge is possible so that the trap will handle large fluctuations in loads. (Fig. 3). In the direct-operated trap the weighted lever directly controls the opening and closing of the discharge valve. The area of the discharge orifice is necessarily much smaller, the trap being unable to handle as severe load fluctuations.

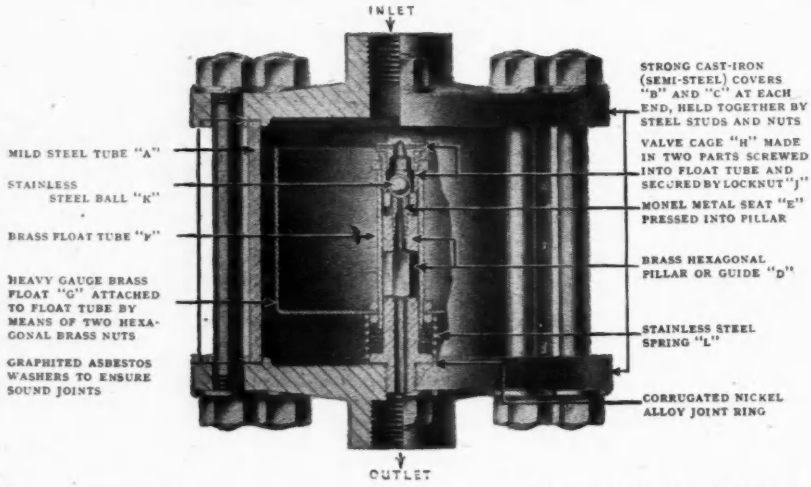
Points in favour of float traps are: (a) They are easily installed, no collecting pipe leg being required. (b) They will handle quite severe fluctuations in load. (c) Condensate is removed immediately, therefore this trap is very suitable for fixing to units where the rate of heat transfer is high for the surface available. Counterbalancing these advantages: (a) Simple types are liable to suffer from wire-drawing of the discharge. (b) Special provision has to be made for the removal of air, *e.g.*, by provision of a thermostatic air release. (c) Damage is

very likely to arise from water-hammer or corrosive condensates. (d) The condensate is discharged almost at steam temperature so that valuable heat units are lost unless a hot well is provided. (e) The degree to which the float is submerged in the condensate is determined by the steam pressure. Therefore at high pressures the float is forced deeper into the liquid, the size of the discharge orifice being reduced. Because of this, differently sized valve seats are required for different pressures and the traps do not function well under severe pressure fluctuations.

A second type of mechanical trap is the open-top bucket type. One interesting form of this—the Newman-Carter trap—comprises a spring-balanced open-top bucket carrying at the centre a float tube. At the top of the float tube is a valve cage carrying a stainless steel ball resting, when the trap is empty, on a Monel metal seating fixed to the top of the discharge tube. Condensate, first filling the bucket, overflows into the body of the trap and, gradually rising, lifts the float. As the float rises it raises the ball valve, and the condensate, forced by the steam pressure up the space between the inside of the float tube and the central pillar carrying the discharge pipe, escapes through the discharge orifice. Two features of interest in this trap may be noted: first, the float, supported and balanced by a stainless steel spring, may be made of much heavier gauge material with increased strength, and second, the ball-valve, housed within the cage, only rests on the seating under its own weight, the contact being unaffected by the weight of the float, wear of the ball and the seating being reduced to an absolute minimum. (Fig. 4).

The advantages of this type of trap are: (a) They are robust and strongly constructed and will withstand water-hammer. (b) With suitably chosen alloys they are unaffected by corrosive condensates. (c) The traps may be used for high temperatures and pressures up to 500 lb. The disadvantages are: (a) Separate provision by manually operated valves, or other means must be made for the release of air. (b) The discharge orifice being relatively small, the trap is unable to handle rapidly fluctuating loads. (c) The traps are large and those employed for high pressure heavy.

In another type an inverted bucket with a small orifice on top is suspended from one end of a crank. The crank pivots about a fixed point and the discharge valve is attached to the other end. The


INLET
MILD STEEL TUBE "A"
STAINLESS STEEL BALL "K"
BRASS FLOAT TUBE "F"
HEAVY GAUGE BRASS FLOAT "G" ATTACHED TO FLOAT TUBE BY MEANS OF TWO HEXAGONAL BRASS NUTS
GRAPHITED ASBESTOS WASHERS TO ENSURE SOUND JOINTS
STRONG CAST-IRON (SEMI-STEEL) COVERS "B" AND "C" AT EACH END, HELD TOGETHER BY STEEL STUDS AND NUTS
VALVE CAGE "H" MADE IN TWO PARTS SCREWED INTO FLOAT TUBE AND SECURED BY LOCKNUT "J"
MONEL METAL SEAT "E" PRESSED INTO PILLAR
BRASS HEXAGONAL PILLAR OR GUIDE "D"
STAINLESS STEEL SPRING "L"
CORRUGATED NICKEL ALLOY JOINT RING
OUTLET

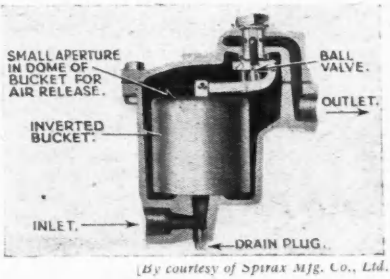
[By courtesy of Newman, Hender & Co., Ltd.

Fig. 4. Newman-Carter open-top bucket trap, with spring-balanced float, suitable for pressures up to 350 lb.

inlet of the trap is located at the bottom of the chamber directly underneath the bucket. When the chamber is full of water the bucket rests on the bottom and the discharge valve is wide open. Steam enters the trap and forces up the bucket, so operating the crank which closes the discharge valve. Part of the air forced into the trap will escape through the small orifice in the top of the bucket and discharge through the open valve. If the rate of condensation in the system is very low; steam retained in the trap condenses slowly increasing the volume of condensate. The bucket falls, opening the valve and discharging condensate, while fresh steam enters and the cycle is repeated. (Fig. 5). The traps will therefore waste appreciable quantities of steam when operating under light loads.

Favourable factors in this type of trap are: (a) They will withstand water-hammer. (b) If made of suitably chosen alloys the traps will not be affected by corrosive condensates. (c) Discharge of condensate takes place immediately. (d) They may be used on superheated steam. Difficulties arising, however, are: (a) Wastage of steam occurs under light loads as indicated above. (b) Condensate is discharged at almost steam temperature. (c) The trap may lose the water seal and will then blow steam for prolonged periods. (d) Discharge of air on starting up is slow. (e) The trap is full when cold and will therefore tend to freeze up. (f) The trap will not handle severe fluctuations of load or pressure.

In selecting a trap for any given piece of plant the following factors must be known: (a) The steam pressure at the trap, or as it might be more correctly expressed, the drop in steam pressure across the trap. The amount of condensate discharged will increase with the difference in pressure between the inlet and outlet of the trap. Some drop in pressure inevitably occurs from the main through the plant to the trap and the actual pressure at the trap inlet should be accurately known. When the trap is discharging at atmospheric pressure the capacity is greatest for any given inlet pressure. If condensate is being discharged from the traps through pipes leading to an overhead return tank, then the drop in pressure from inlet to outlet is diminished, with a corresponding reduction in the discharge capacity.



[By courtesy of Spirax Mfg. Co., Ltd.

Fig. 5. Inverted bucket trap suitable for pressures up to 200 lb.

(b) The amount of condensate to be handled. For efficient operation the trap must be capable of handling the maximum condensate load, the peak occurring most frequently during the starting up period. When starting up the pressure is frequently lower than in normal working.

Factors which profoundly influence the behaviour and life of traps are (a) water-hammer; (b) corrosive condensate; and (c) grit. Water-hammer, caused by the sudden stopping of a body of water in motion, may be minimised by preventing the accumulation of water pockets in steam mains or heating pipes. The impact of live steam on such water pockets is liable to cause rents in pipes with severe damage to plant and danger to operators. Two points are important in preventing this: first, attention to the design and lay-out of piping which will render the accumulation of water pockets unlikely; and second, suitable choice of traps. As already noted, certain designs of trap will not withstand water-hammer, *e.g.*, thermostatic types, and must therefore not be employed where such conditions exist.

Corrosive condensate may arise from incorrect softening treatment of the boiler water, from leaking process coils, from certain direct steam injection processes, or from dirty boiler-feed water. Certain types of trap are very susceptible to this trouble and in serious cases it may be overcome only by installing all-metal traps made from special corrosion-resisting alloys.

Grit particles trapped in the seating prevent the valve closing tightly. Escape of steam takes place continuously, and in a very short time the seating is very

badly cut by the steam. In this condition continuous loss of steam occurs even after the grit particle has been removed. The presence of suitable strainers before the traps is almost a vital necessity for efficient working.

The selection and installation of a suitable steam trap will have a decided influence on the whole system of fuel efficiency in a plant. A number of factors will be considered, bearing on this question of trap design and fuel efficiency.

(a) *Use of Superheated Steam.* For normal drying processes, so common in chemical industry, superheated steam offers no practical advantages. Superheating increases steam temperature considerably, but adds little to the total heat. The superheat causes the steam to expand so that heat content per cu. ft. is less than that of saturated steam at the same pressure. Further, when saturated steam is in contact with a cool surface it gives up most of its heat and condenses, the space previously occupied being immediately rendered available for more steam. Superheated steam in contact with a cool surface contracts first before condensing so that a longer period is required for the transference of the same heat content from steam to radiating surface.

(b) *Removal of Air.* Air is present in all steam spaces before starting up, while varying quantities are carried by the steam from the boiler. The presence of air is attended by two disadvantages. First, the steam temperature becomes progressively reduced with increasing quantities of air. Second, air, carried to the radiating surfaces by the steam, is deposited as a stagnant film. This film acts as an insulator, preventing transference of heat from steam to the surface. Traps must be capable of discharging air easily and rapidly, or automatic air vents must be provided.

(c) *Prevention of Steam Locking.* The condensate in any system will flow by gravity to the lowest point, to which, naturally, the trap must be connected. Some thought may be necessary to determine accurately the real drainage point of any system, otherwise a steam pocket may form between an accumulation of condensate and the trap, causing water-logging of the plant.

Where the plant to which the trap has to be attached is in a relatively inaccessible position, *e.g.,* below ground level, the piping system must be carefully considered. A pipe leading from the natural drainage point to the trap at a higher level is particularly liable to produce a steam lock. Until the steam in the pipe leg and trap body condenses, the accumulated condensate from the plant will be unable to pass to the trap. serious loss of heating efficiency and waterlogging being a common occurrence. A steam-lock release may be fitted to traps employed under these conditions, such devices allowing steam in the pipe leg and trap to escape.

(d) *Arrangement of Traps.* Condensate from a group of steam-heated machines is frequently allowed to discharge to a common main served by one steam trap. This practice, known as "group trapping," leads generally to inefficient working and to loss of heat. Each of, say, three machines on the line will not normally be at the same stage; one may be shut off and emptying, one at maximum temperature, and one starting up. Vastly different quantities of condensate are forming in each instance, but, where served by a common main, steam from the smaller and more lightly loaded units will reach the trap, causing it to close while condensate is still forming rapidly in one of the other machines. Serious waterlogging and inefficiency are the normal outcome of such conditions. Considerable improvement in performance is obtained if separate small traps are fitted to each individual unit.

The return of condensate to the boiler in preference to allowing it to run to waste has three distinct advantages: (1) Condensate is completely softened feed water, no chemical treatment being required. (2) Formation of scale is minimised with increased life of the boiler and reduction in maintenance charges (3) The sensible heat of the condensate is saved. All three advantages represent important economic features, but under present-day conditions the last is probably paramount.

A criticism of condensate saving that may be made where economisers have been fitted is that additional plant and equipment are necessary to do what is being done more efficiently by the economiser. In reply to this it may be pointed out that the distinct savings in chemical treatment of feed water and reduction in scaling are still effective,

while feeding hot condensate to the economiser will prevent " sweating " on the first row of tubes. Even where the economiser is more efficient a supply of soft purified water is a considerable asset for many purposes in a chemical plant. No pumping gear is required to lift the condensate from the drainage points to the condensate return main connected to the boiler feed tank. Whenever the full steam pressure actually reaches the trap the discharged condensate may be lifted through a height of $2\frac{1}{4}$ ft. for every pound of pressure at the trap. To allow for pipe friction and other minor losses the safe figure of a 2-ft. lift for each pound of steam pressure may be employed.

An important point arises in this connection regarding the discharge capacity of traps. A trap discharging condensate up a pipe to the return main is working against a back pressure proportional to the height of the lift. This back pressure is equivalent to one pound for every 2 feet of lift, the discharge capacity of the trap being correspondingly reduced.

For the successful installation of condensate saving by steam traps the following factors may be considered: (a) The lay-out of the piping; (b) the positioning of the trap; and (c) the use of check valves.

(a) Where a number of units are connected to the same steam main, a trap fitted to the lowest point of the main will ensure rapid removal of condensate. The branch line supplying the units should be taken out at the top of the main, thus preventing condensate being mixed with the steam. The condensate rising line (return pipe) from the unit should always be taken in at the top of the condensate main, so preventing condensate running back, a check valve being fitted at the bottom of each of the rising lines. To select a return pipe of the correct bore is also important, the pipe being just sufficiently narrow so that condensate fills it completely, no steam being allowed to by-pass. (Fig. 6).

(b) Thermostatic traps may be fitted either at the top or bottom of the rising line. When fitted at the top, a check valve is necessary at the bottom, but a check valve should be fitted after a trap placed at the bottom of the lift. Float traps must be installed at the bottom of the rising line, efficient operation being impossible in any other position. A check valve is essential after the trap. Inverted bucket traps function best at the bottom of the rising line, but if that position is impossible they may be fitted at the top with a check valve at the bottom.

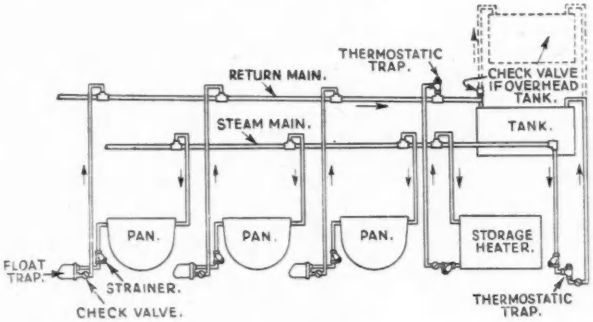


Fig. 6. Arrangement of different types of traps, check-valves, etc., in a lay-out designed to return condensate to a higher level

[By courtesy of Spirax Mfg. Co., Ltd.

(c) Check valves, operating on the same principles as those employed on boiler feed-water lines, may be installed very usefully on condensate return systems, while in certain circumstances they are essential. The function of these valves is to prevent condensate running back through the rising line when the plant is cold, *e.g.*, at night, and to prevent any back pressure in the common condensate main interfering with the free operation of the trap.

The following firms have furnished extensive data and particulars of the products they manufacture and the author is indebted to them for this help: Spirax Manufacturing Co., Ltd.; The United States Metallic Packing Co., Ltd.; and Newman, Hender and Co., Ltd.

Accessory Features of Chemical Plant

Co-operation Between Maker and User

by C. H. BUTCHER

AS users of chemical plant we may often be accused of thinking lightly about "plant accessories," yet much of the efficiency of our plant is really dependent on the good quality and functioning of accessory features. To make a list of the things that may be regarded as plant accessories would serve no useful purpose in this particular instance, for there are far too many to name if we are to avoid the monotony of reciting them catalogue-wise. Let it suffice to say that they are numerous and diverse, and that each individually contributes, in its own particular manner, to plant operation. Again, there is really no definite line to be drawn in treating of "plant accessories": there are numerous small and very essential things such as valves, steam traps, and gland packings, and also bigger features such as electric motors, conveyors, and agitating devices.

Plant Users' Experience

Plant accessories, each made to serve a purpose as part of the complete plant, have refinements of design and quality which it is wise to consider carefully when the need comes to use them. It is only when the correct design and quality has been adopted that we may even expect a high degree of service. Indeed, one particular accessory feature may be of great importance in attaining this end, for, remembering the old-time nursery jingle telling how "the battle was lost all for want of a horse-shoe nail," we see the same state of affairs in modern chemical engineering where one defective valve or one weak joint can adversely affect the operation of the whole plant and also its useful life. The experience of the plant user shows where there is need for some refinement or improvement. In the early days of chemical engineering it may have sufficed to order "a valve"; to-day, it needs to be "a particular valve," perhaps in make as well as pattern and material. The shell of the plant, even the general assembly of vessels and machines, is unthinkable—indeed, incapable of functioning—unless certain accessory features are present; and it is the correct choice of these accessory features which really determines how well the complete plant will operate in performing the duty for which it has been designed.

The subject of plant accessories is too wide to permit detailed treatment of various types of accessories in the space of a single article; but something useful can be done as a reminder that plant accessories have a purpose to serve and that it is only by getting thoroughly acquainted with them in their types and refinements that we may ever hope to use them to fullest advantage, with a true appreciation of their limitations in service. In this matter there is no better tutor than the literature issued by the different makers of accessory features, for herein are pointed out those features which distinguish their productions from that of another maker, and though the difference may be small, it is likely to be outstanding in the matter of reaching some desired end according to the needs of the plant user.

Electric Motors

Power production and power transmission are accessory features of plant where there are moving parts; included is the electric motor; following the motor, come belts and chain drives, motor starters, shafting and pulleys, agitating gear, and guards giving personal protection against the hazard of moving machinery. The motor may be efficient and yet power can be lost in a weak drive; power transmission can be perfect from countershaft to fast-and-loose pulley on a reaction vessel, but bad design in agitating gear can offset all the good work which has gone into the design and construction of a motor. Makers of electric motors have done much to attain high efficiency and long serviceable life. One emphasises the extra protection which is afforded in construction from frame to shaft, bearing to bearing, all for good service to the user; a wide rib, integrally cast with the frame, forms an unbroken circle of protection around the stator chamber and, acting like an anchored shock-absorber, it gives the entire structure a high resistance to shock. Moreover, in covering the bottom of the motor there is protection against the entry of

dust and dirt and foreign particles which cause abrasive wear, and still—by careful thought in details of construction—there is also complete ventilation of interior parts. Other features could be recited, each giving additional service. In the language of the electrical engineer, one design has achieved "increased cross-strength and interphase insulation to improve the efficiency of distortionless stator," and for another—what all engineers can appreciate—there are oil drains at the bottom of the bearings "for easy flushing and faster maintenance." These words, from many which might be written about electric motors, embody sound principles.

Recording Instruments

From electric motors we pass, randomwise, to indicating and recording instruments, another essential feature (or one of the accessories, if you have preference for that word) of nearly all chemical plant, ranging from the simple indicating gauge for steam pressure on a jacketed pan to elaborate recording-controllers for continuous processing plant. As plant grows more complicated in function (not necessarily in construction) and reaches the state of being continuously in operation, there comes a special need for control instruments which have to be sensitive to the utmost degree dictated by the process. Accuracy in operation, and sensitive reaction to sudden change, may have to be provided with a robust construction such as will allow the instrument to be installed in situations where there is exposure to weather. Added refinements give ease of inspection, cleaning, and adjustment, and resistance to external influences which may affect reliability. An illustration in this instance could be drawn from instruments needed at oil refineries, with exposure to outside weather, but the same facts could be related in respect of plant placed in a modern weather-proof building and engaged in the manufacture of some pharmaceutical product on a relatively small scale.

The handling of liquids involves pumping as a plant operation; pumps, then, are accessory features at the bigger end of the list, like the electric motor which provides power. A recent introduction makes further headway in the direct-coupling of centrifugal pump and motor for efficient operation. With a totally-enclosed construction, the number of joints in the sections fitted together is reduced from five to three; for advantage, there is "more perfect alignment of the shaft, less vibration, less wear, less trouble." Two section-fits were eliminated in the design by the draughtsman, and the engineer who looked at the result and gave test found no purpose in continuing to build such combined electric pumping units with the five original section-fits.

For another achievement consider the following: As many as 480 combinations of alloy, type and size, with heads and capacities to meet almost any requirement, are offered by one maker of corrosion-resisting centrifugal pumps, normally made of high-silicon iron, but convertible to stainless steel pumps merely by substituting stainless steel wet-end parts; the conversion can be made without disturbing the setting of the pump, and this is a feature to be appreciated where there are frequent changes in process or liquids handled. The high-silicon irons can be used for sulphuric or hydrochloric acid; the stainless steel, for strong alkaline solutions.

Screw Conveyors

From fluffy milk powder to heavy and highly abrasive rock-like material, indeed, for all degrees of resistance against movement, there is a type of screw conveyor which is best suited for the task of point-to-point moving within the works. But screw conveying, though an accessory feature of plant, is equally a highly specialised job in design and installation; a screw conveyor looks a simple affair, and is often believed such, merely because the screw is an elementary principle of mechanics like the lever. The maker of screw conveyors, however, is wiser than we who have occasional need to make use of this handy means of moving solids or semi-solids continuously from one point to another. He knows that certain conditions may call for a conveyor trough with "twin screws of opposite hand," because the nature of the pulp demands this mode of operation; it is therefore well to put all the available facts of a problem before him. A sectional screw conveyor with its "easy to repair" feature is now standard equipment; it can be made for particular diameters, gauge, and pitch of flights, and the flights are easy to replace when

worn or damaged. Nevertheless, efficiency of operation depends upon whether the design is correct for the material to be handled, and this material may be "corrosive, abrasive, hot, or sticky," or "fluffy, fibrous, globular, or slippery."

As one of the bigger accessories of chemical plant the conveyor has its own smaller accessories in the form of bearings, hangers, troughs, drives, feeders, and gates—to mention a few of the things which make the system complete. There is much knowledge involved in the complete assembly; forged lugs welded to the pipe and flight at both ends take thrust and add rigidity to the system, while solid steel bushings pressed in pipes add thickness and strength at coupling points.

From what has been said thus far, it is evident that in selecting plant accessory features there is need for the closest co-operation between the user of the plant and the maker of the feature, be it big or small in importance. The plant user knows what he needs, or at least it is hoped that he has some idea in that direction; it is only by putting his needs as clearly as possible before the maker of the accessory that the latter is able to draw upon his experience and offer the best thing for the purpose with due consideration of permissible cost.

Switch Gear

Accessories for the electric motor include starters and switch gear. They need two desirable features, apart from operation: first, they must offer protection to personnel, and, secondly, they must safeguard the plant which is put into movement; and let it be remembered that to safeguard the plant is an indirect way of saying "safeguard production," especially continuous production. There must be safe and easy means for inspection, circuit-breakers being easy to withdraw and replace so that it is always possible to inspect them out of reach of live parts of the equipment. Moreover, all conducting parts must be amply insulated, every part being able to withstand short-circuit stresses equal to the rating of the circuit-breaker.

Valve design incorporates a very large number of refinements; the patterns available are multitudinous, but it is evident that there has been something achieved for simplicity's sake when one maker offers means whereby it is possible for the user to assemble 26 different valves from four bodies and a handful of spare parts, every one of the complete valves giving drop-tight closure. The four bodies are provided by globe or angle patterns, each either screwed or flanged; these can be fitted with outside "screw and yoke" when service conditions need it; "throttling" service is secured by putting a throttling nut in place of that which holds the disc in the disc-holder; "quick-opening" service comes by substituting another bonnet and spindle with the threads pitched to permit full opening with one-quarter the usual number of turns. With bodies made of bronze, these valves have renewable composition discs; the disc is selected according to pressure, temperature, and nature of liquid to be handled.

Flexible Tubing

Passing over pipes, so closely associated with valves, a few words may be included concerning flexible metal hose and tubing. The making of this accessory is highly specialised, and there are numerous chemical plant applications for it, irrespective of whether it is square-locked flexible steel tube, seamless flexible bronze tube, or flexible aluminium shielding conduit. Appropriate types can be used to convey steam, oil, hot tar, and other fluids under severe service conditions, at pressures up to 500 lb./sq. in. A variety of assemblies with end fittings have solved many problems and increased the operating efficiency of plant; with a neat streamline design for an awkward connection, there is also reduced maintenance cost. On tank cars which transport heavy viscous asphalt, a small hose of interlocked bronze will carry steam for heating the asphalt before discharging; larger flexible hose of interlocked steel is used to transfer the hot fluid asphalt to storage tanks.

Length of life in the matter of power transmission by flat belting, apart from ill-usage, is largely a matter of the appropriate strength and quality of the belting, but with V-belts there is a refinement in design which enters the question. When an ordinary V-belt is made to bend, as in its passage over the pulley, the top of the belt is put under tension and becomes narrower, but at the same time the bottom of the belt is under pressure and widens; this change in shape can be felt when a piece of the

belt is bent loop-wise. These stresses, if the belt has straight sides, cause bulging in the sheave groove, as a result of which there is uneven wear on the sides of the belt, and shorter life. Invention on the part of a maker of V-belting has provided a belt with concave sides, so proportioned that this bulging is corrected; such belts serve a longer useful life, with power consumption reduced, and there is the added advantage that heavier loads can be carried without "slippage" of the belt, because the side walls of this improved belting have a better frictional grip on the pulley.

From V-belts we pass on to roller chain drives, and observe that a certain make has "a positive lubrication system built in every link." By the provision of a lubricating channel on the pin of each link, oil reaches the heart of the chain and pins and bushings turn on a film of oil, with notable achievement in reducing repairs and replacements.

Smaller Accessories

It is in the smaller plant accessories more than elsewhere that confidence has to be placed in the makers' ability to provide goods at a certain standard of quality and to offer the same in the variety of pattern needed by the user. This is particularly true in the case of gland packings and jointing material, wire screen, spray nozzles, and boiler fittings; steam jets for heating, circulating, agitating, or dissolving solutions, and promoting absorption of gases in liquids; ejectors for clearing sumps, emptying tanks, and starting a siphoning action; stirrers and agitators of portable pattern; and many other "accessories" which could be mentioned. Those who use metallic filter cloth or wire screen want this material to be of the right design, properly woven and enduring. Screen is available for nearly every filtering, dewatering, cleaning, sizing, and grading purpose, and is made in a variety of metals. The user may point out his need as being ability to resist corrosion, or ability to filter properly with high throughput. The maker offers his product with due assurance of constancy of quality, the result of having developed a highly skilled method for accurate weaving, coupled with the correct choice of materials.

It was in 1915 that Arthur D. Little, in the United States, first pointed out that "any chemical process may be resolved into a co-ordinate series of unit operations" such as pulverising, drying, roasting, leaching, filtering, evaporating, crystallising, drying by centrifuge, etc. Each of these unit operations demands certain accessory features of plant for the performance of the expected duty. The mill engaged in pulverising has to be fed continuously by a conveyor; both mill and conveyor need power, provided by the electric motor. These bigger features—conveyor and motor—have their own smaller accessories which provide for efficient operation; the many small features that are built into a conveying system have been mentioned, and reference has also been made to the starter for the motor. The bigger things are better spoken of as "auxiliaries"; the smaller things as "accessories." The true degree of importance of each individual example which might be mentioned—be it auxiliary or accessory—only becomes plain when we see the feature in position upon the plant and understand its function and limitations.

Anti-Rust Process

Glycerine and Alkali Treatment

A PROCESS to inhibit rusting, which is claimed to be more efficient than the usual method of oil-treating metals after pickling and to do away with disadvantages in the further processing of the metal, has been patented by R. W. Shoemaker (U.S.P. 2,257,133) The method used is designed to neutralise the pickling acid more effectively and to clean the metal to prevent corrosion after the pickling operation and before cold rolling or other processing. Several methods, most of them employing the action of glycerine, are given in the specification. All are based on the discovery that metal articles can be prevented from rusting after pickling by virtually removing all traces of acid from the surface and pores of the metal and immediately treating such surfaces to prevent oxygen from gaining access.

A typical example of the procedure employed is as follows: after pickling, the metal is rinsed in a solution containing caustic alkali soap and a wetting agent (*e.g.*, sodium metaphosphate or hexametaphosphate). The metal is then coated with a solution containing glycerine. The inventor adduces that the protective quality of the polyhydric alcohol is enhanced by the presence of hydroxyl ions from the alkali used, so that the glycerine in combination with an alkali furnishes a better protection than either glycerine or alkali alone.

Flue-Gas Analysis

The Orsat Apparatus : Its Value in Fuel Economy

THE importance of flue-gas analysis in effecting fuel economy has been dealt with recently in this journal by Dr. D. D. Howat; in his articles he also described several pieces of apparatus which automatically indicate or record the CO_2 content of the gas stream. There is in fact a number of such pieces of apparatus on the market, all of great assistance to the furnace operator, but in practically every case dealing only with the CO_2 figure. If we make a study of furnace working problems, we find, however, that the more valuable figures in flue-gas analysis are those for free oxygen or unburnt gas such as CO, H_2, or methane, and that the CO_2 figure is studied mainly owing to the greater ease of obtaining it, and it is used only as an indication of the excess air in the flue.

E. G. Bailey has pointed out in a valuable paper* on furnace operation that one per cent. of unburnt gas in the flue is more wasteful than 15 per cent. excess air, and he gives figures which he has found by numerous complete flue-gas analyses for the excess air requirements of different fuels and types of furnace which will ensure complete combustion; these also take into account the necessity for employing excess air in the furnace in order to lower the combustion temperature, when this is necessary to give a longer life to the furnace parts. Such considerations, therefore, indicate the value of complete flue-gas analysis, and enhance the claims of the Orsat type of apparatus as being essential to fuel economy. In its simplest form, shown in Fig. 1, provision is made for estimating the CO_2 and O_2 contents only of the flue gas, and it may be put safely in the hands of a skilled furnace attendant. The best results are obtained, however, if the apparatus is under laboratory control, and possesses at least three bulbs for absorbing CO_2, oxygen, and carbon monoxide respectively, or if it is fitted in addition with a palladium asbestos tube and heater with the corresponding reservoir for estimating small quantities of inflammable gases by combustion. Such an apparatus is shown in Fig. 2. The Orsat apparatus is, of course, very much cheaper than any form of automatic apparatus.

The principles of construction and operation of the Orsat are generally well-known to those who handle gases. They are very simple and are adequately described in books on furnace work; in any case instructions are usually available with the apparatus which is on the market. An important consideration, however, to which sufficient attention is not always given is the method adopted for taking samples. If possible, the sample should be drawn directly from the base of the flue at the sampling point provided, using a non-corrodible metal tube of suitable length, so that the sample may be taken from different points in the flue in case striation is suspected. The sampling hole should, of course, be carefully plugged round the tube to ensure no air leakage at this point. The tube is connected directly to the Orsat apparatus by rubber tubing and thoroughly swept free from air by means of the pump provided. After this the normal procedure is followed in carrying out the analysis.

Instead of taking the sample into the Orsat directly from the flue, sampling vessels may be employed, usually taking the form of tubes of suitable capacity provided

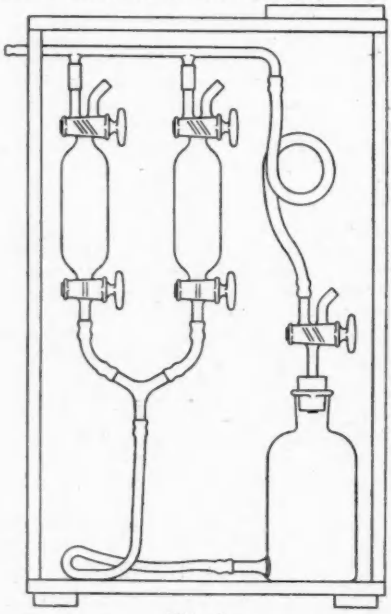


Fig. 3.

at each end with three-way stopcocks. These vessels may be thoroughly evacuated, using a pump which will give a vacuum better than 1 mm. absolute, and subsequently attached to the sampling tube described

* "Limiting Factors in Reducing Excess Air in Boiler Furnaces" by E. G. Bailey, *Mechanical Engineering*, July, 1926. (Obtainable from Messrs. Babcock & Wilcox, Ltd.)

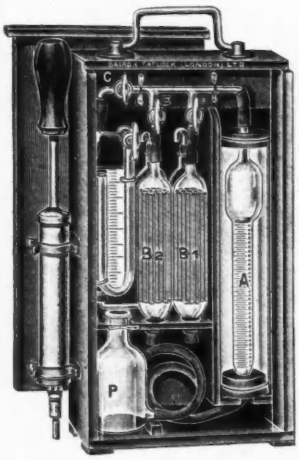


Fig. 1.

Three types of Orsat apparatus: Fig. 4 shows a type specially suited to producer-gas analysis.

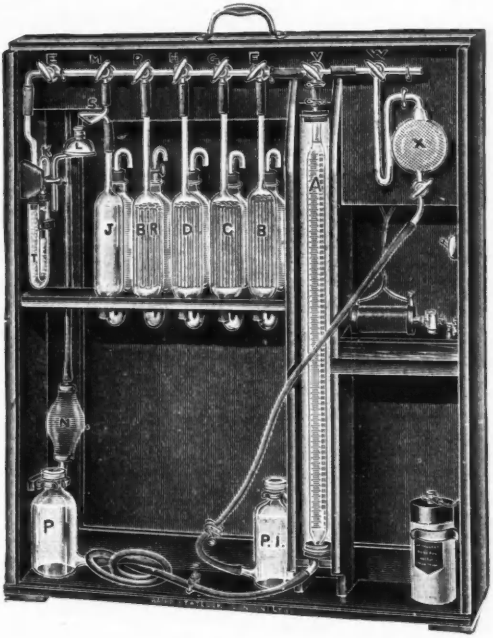


Fig. 4.

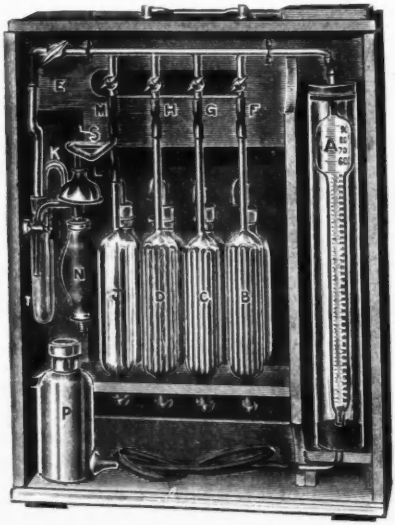


Fig. 2.

above, which has already been swept free of air. The sample tubes may otherwise be filled by displacement of water or another confining liquid which has itself been saturated with the furnace gases. If properly handled, the latter method gives good results, but errors may creep in if the liquid used should give up some gas to a later sample. A method of avoiding this source of error has been described to the writer by Mr. W. A. Moorshead, of The United Glass Bottle Manufacturers, Ltd. (shown diagrammatically in Fig. 3, opposite). Two sampling vessels are employed and an aspirator of more than sufficient capacity for both. Provision is made for connecting the aspirator itself to the flue in such a way that when it is raised to displace air from the sampling vessels, flue gas is drawn into the aspirator so that the confining liquid may also be saturated with the same sample. Samples may then be taken in the sampling vessels either in duplicate from the same point in the flue or at practically the same time from different points. The system, therefore, provides both for duplicate analyses and for making a true check on striation.

The latest form of Orsat apparatus designed for the analysis of producer gas or

the gases from transformer oils is shown in Fig. 4. It is provided, in addition to the usual absorbers, with an extra bulb to contain bromine water for the estimation of unsaturated hydrocarbons, and an explosion bulb with sparking coil and battery suitably arranged. It possesses a straight burette of 100 ml. capacity graduated to give percentages to 0.2 per cent. over its whole length. This apparatus again serves as the final referee of the correct operation of a producer, and it must be realised that it is the basis of calculation for the operation of any automatic instrument which is based on temperature or pressure at the gas outlet, or the CO_2 content of the gas. The explosion bulb, in conjunction with the long burette, is used for estimating hydrogen and methane in fairly large quantities, but in those producers which operate only with air and coke the small quantities of hydrogen and methane are better estimated by using the palladium asbestos tube. The apparatus naturally covers all the requirements of the simpler Orsat apparatus, so that it is available for examining also the flue gases from the combustion of the producer gas in order to obtain best resuls at this stage.

The blocks for Figs. 1, 2, and 4, and the drawing for Fig. 3 were supplied by courtesy of Messrs. Baird & Tatlock (London), Ltd.

Britain's Food Possibilities

Chemical Fertilisers Aid Towards Self-Sufficiency

"BRITAIN produced in 1938 approximately one-third of her total food requirements on her own soil and imported the remaining two-thirds. In order to produce the whole of her foodstuffs, she would therefore require to treble the output of her available agricultural land." With this simple sentence Lt.-Colonel George P. Pollitt, D.S.O., M.Sc., Ph.D., opens a book in which he sets out in the most practical way possible, and with the same economy of expression with which he begins, a case for the production in Britain of the foodstuffs required to feed the whole population. The book is called "Britain Can Feed Herself" (Macmillan; price 3s. 6d.; 50 pp.), and the author is well qualified to deal with his subject, for he himself farms 900 acres of land in Shropshire where he has put into practice the methods described in his book. Colonel Pollitt is a director of Imperial Chemical Industries, Ltd., and is a research chemist of wide experience.

The yield required for self-sufficiency (on the larger acreage proposed) is, says the author, 25 cwt. compared with the 40 cwt. which was probably the maximum yield on the best farmed and most suitable land before the war. There is, he believes, very little land in England which, if drained, limed, slagged, dressed with ample farmyard manure and top-dressed as required, will not easily reach the required figure. As might be expected, Colonel Pollitt devotes an important part of his book to the question of fertilisation of the soil necessary to ensure this yield.

Fertilisers which need to be supplied are 3,680,000 tons of sulphate of ammonia, 1,130,000 tons of basic slag or superphosphate, 474,000 tons of muriate of potash, and 16,600,000 tons of calcium carbonate. Annual applications per acre of fertilisers and lime will be just over 2 cwt. of sulphate of ammonia, just over 2/3 cwt. of basic slag or superphosphate, ¼ cwt. of muriate of potash and about 10 cwt. of $CaCO_3$. Allowance, however, must be made for a certain loss of nitrogen—a proportion not being absorbed by the plants.

The knowledge of how to use artificial manures, says Colonel Pollitt, is steadily increasing among farmers, but there are as yet few who use them in adequate amounts; particularly is this so in the case of nitrogenous fertilisers. "Where the cultivation of the land is bad and where the land is dirty or deficient in lime, it is a waste to apply artificial fertilisers, indeed it is a waste to sow a crop at all," he goes on. "But where the land is clean and has been well worked, less seed can be sown and, therefore, in the case of corn crops, there is less risk of lodging. It is under these conditions desirable to apply far heavier dressings of nitrogenous fertilisers than the average farmer at present considers possible."

BERYLLIUM-LITHIUM ALLOY

Small amounts of beryllium and lithium, from about 0.001 per cent. to about 0.02 per cent., added to aluminium-magnesium alloys are stated to prevent oxidation of the magnesium and the formation of dross on the surface of the metal when melted, according to U.S.P. 2,293,864, asigned to the Aluminium Company of America. The oxidation and the formation of dross carry away a good deal of the valuable magnesium, and the use of beryllium and lithium not only prevents this waste but also obviates the use of prospective fluxes or an inert atmosphere above the molten metal. While the inventor prefers equal quantities of the two metals, he says that in some cases the amount of lithium may be increased so long as the total amount is the same.

Automatic Processing Plant

Descaling of Metals : Oxidation from Atmosphere

IN recent years there has been a considerable expansion in the use of electrolytic processes in industry. These developments, together with the spread of mass production methods, have created a demand for an automatic plant suitable for electrolytic work. The Electro-Chemical Engineering Company, Ltd., has sent THE CHEMICAL AGE details of its duplex carriage automatic plant which, says the company, makes possible considerable reductions in cost, by the elimination of handling between operations and the improvement in the quality of the work consequent upon the standardisation of processing conditions. It consists of two moving carriages carried on a steel structure. Chains are suspended from the upper carriage and pass over pulley wheels on the lower carriage. A single electric motor is used for the drive, which is obtained through a worm reduction gear box, first on to the upper carriage and then through a further worm reduction box to the lower carriage.

The plant operates in the following manner: the upper carriage moves in the forward direction, and raises the lifter hooks and work baskets, as shown in Fig. 1. Both carriages then move forward taking the work basket forward from the loading point to the first tank. The next stage is illustrated in Fig. 2: the upper carriage moves backward lowering the hooks and the basket into the first tank. Both carriages move forward disengaging the hooks and

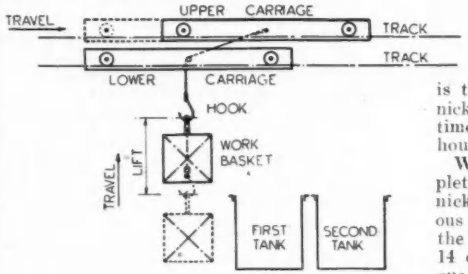


Fig. 1.

leaving the basket in the tank. From this position the upper carriage moves forward tightening the chains and lifting the hooks alone. When both carriages move back, the hooks are returned ready for the next transfer. The upper carriage is still in the forward position; but now it moves back, with the result that the hooks are once more lowered as in Fig. 2. Now both carriages move back to the starting position, the first set of hooks engage with a new basket at the loading end and a second set of hooks with the basket in the first tank. After an appropriate time interval the cycle is automatically repeated and each crate is immersed in turn in every tank.

The duplex carriage principle has been adapted to suit a number of different processes. There are, for instance, processes in which the period of immersion in each tank is the same. As an example may be given the acid pickling process used for annealed brass articles. An acid pickle is

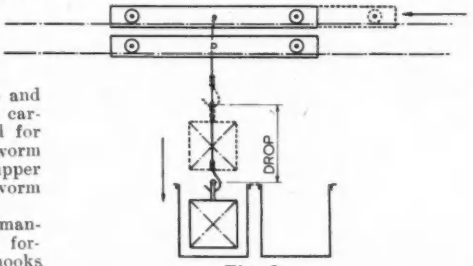


Fig. 2.

followed by either two or three wash tanks. The period of immersion in each tank is the same, and it is usual to use three or four tanks of identical size. Each cycle of operations moves a crate one stage down the plant. There are certain processes, such as electro-plating, where the immersion time in each tank may be different. In an automatic nickel plating plant, for example, work will pass through cleaner and swill tanks first, where the required period of immersion is two or three minutes, then through the nickel-plating tank, where the immersion time will be between thirty minutes and an hour.

Working on this principle, the first completely automatic plant for plating bright nickel and chromium steel as one continuous process was constructed. This plant, the largest of its kind in Europe, has 14 different tanks in one line. A continuous conveyor chain running along the sides of the vats has the advantage that this chain can be adapted to return over the top of the plant, and can be used for returning work bars or baskets to the feed end.

The following general specification is given, covering the majority of equipments. Details vary to meet individual requirements. The plant consists essentially of a heavy section steel structure, designed to carry the drive unit and provided with two horizontal tracks on which the carriages

can move. The carriages are fabricated from angle sections and plates and are designed to be both light in weight and to have a large cross-sectional area to resist deflection under load. Each carriage runs on cast wheels fitted with self-lubricating bushes. The drive unit is fitted to a bedplate carried on the top of the plant. It consists of a three-phase squirrel cage induction motor, with A.C. brake, connected through a flexible coupling to a single reduction worm gear box. The output shaft of the gear box drives through a rack chain and pinion on to the upper carriage. The worm shaft of the gear box has an extention giving a straight through drive to a magnetic clutch, the armature of which is connected to the worm shaft of a second gear box. The output shaft of the second gear box drives the lower carriage through a sprocket and rack chain. The extension shaft of the second gear box carries a pulley on which a D.C. brake operates. The D.C. brake is connected in parallel with the magnetic clutch, so that the brake is applied to the lower carriage drive immediately the magnetic clutch is released.

The hooks are raised or lowered by driving the upper carriage only through the first gear box. A forward motor rotation raises the hooks and a reverse rotation lowers them. The hooks can be made to travel forward or backward by exciting the clutch and removing lower carriage brake. Both gear boxes then drive together. The function of the electrical control gear is to ensure that the motor and clutch are connected at the correct points of the cycle. A single master controller works in conjunction with two rotary limit switches operated by the carriage drives. A timing device is fitted in the panel for restarting the cycle after a predetermined period which is adjustable. The tanks are of mild steel plates, welded construction, and are lined with lead, rubber or other material depending on the solutions they are to contain.

Scale Removal

A method of removing scale from metals is also described by the Electro-Chemical Engineering Company, Ltd. In a recent booklet, the writer states that, to realise economies to the greatest possible extent, it is necessary to use a method which descales completely without the slightest damage to the work. The Bullard-Dunn process, it is maintained, overcomes the disadvantages heretofore experienced in the removal of scale. This is indicated by the acceptance and successful operation of this process in many plants of international reputation on work requiring low manufacturing costs, and high quality finish. Among the many products on which the process is being used during the course of their manufacture are: aeroplane engines, tractors, machine tools, electrical equipment, air compressors, pumps, and diesel engines.

This process is an electro-chemical method of removing scale and oxides from the surfaces of metals, particularly the ferrous metals. Its characteristic feature is that a continuous and non-porous metal film, usually tin, electro-deposited on the work simultaneously with the scale and oxide removal, completely protects the work surface from pitting and etching. This metal film can be removed easily and completely, although it is usually advantageous to permit it to remain on the work. Chemically clean surfaces are, it is stated, produced in this way. Scale is removed so thoroughly from heat-treated work that subsequent grinding operations are done at minimum cost. The life of the acid descaling solution is long because none of the basis metal is dissolved, and the process operates efficiently at high iron concentrations.

The process utilises electric current which greatly shortens the time required for the removal of scale. The protective metal film, deposited on the work in the descaling bath, can be stripped completely, if desired, in a separate alkaline electrolytic treatment which also does no damage to the work. General procedure is unaffected by differences in composition of the metal to be descaled or differences in the origin of the foreign matter to be removed. Grease removal, when needed prior to descaling, can be accomplished by using vapour or solvent degreasers or proprietary alkaline cleaners. Manually served tanks can be used, and full or semi-automatic conveyors can be employed.

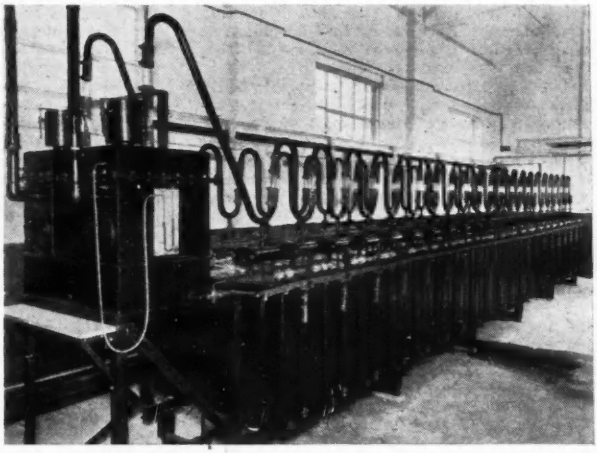
The Ecco Oxidiser

An interesting product of the Electro-Chemical Engineering Company is the Ecco Oxidiser which has been developed to perform the function of making available for chemical purposes atmospheric oxygen. It has been found that the efficiency of this unit is greater than that of any of the methods mentioned, the oxygen being highly activated. Essentially the unit consists of an axial flow pump driven by an electric motor, and a tapered venturi tube between the pump inlet and the top. Concentric with this is a small air aspirator tube. The apparatus is immersed in the solution with the pump part and venturi tube completely immersed, but the aspirator tube in the centre projecting into the atmosphere. The solution is pumped downwards into the tank, and owing to the restriction, the venturi part of the large tube causes air to be induced through the central tube. The oxygen of the air becomes highly activated in the throat of the venturi, causing efficient oxidation.

Electrolysis of Water

Plant for the Production of Pure Hydrogen and Oxygen

THE ever-increasing demand for the two very important industrial gases, hydrogen and oxygen, has made the electrolytic method for their production extremely attractive if only from the point of view of its convenience. Pure water being the only raw material required, the general availability of electricity makes it possible to instal the relatively simple equipment almost anywhere.



A small installation of Knowles electrolytic apparatus constructed by the International Electrolytic Plant Company, Ltd., Chester. The 22 1000-amp. cells produce 354 cu. ft. of hydrogen and 177 cu. ft. of oxygen hourly and absorb 48 kWh.

The British-built Knowles cell is an excellent example of electrolytic hydrogen and oxygen gas-producing apparatus. Gradually developed over a period of forty years, Knowles cells have enjoyed considerable popularity, plants having been installed for producing quantities of gases per hour varying from a few cubic feet to nearly one quarter of a million. A Knowles installation comprises a number of cells of the required capacity coupled electrically in series to form a battery, and an arrangement whereby the gases produced are washed and from which the make-up water is automatically fed to the cells.

The cell proper is composed of a series of electrodes, each of a definite current capacity, arranged alternately anode and cathode, electrodes of opposite polarities being paralleled electrically. Each electrode is provided with its own gas-collecting bell from which it is suspended by means of pure iron conducting leads passing through, and suitably insulated from, steel tubes. These latter, by virtue of their being partly immersed in the electrolyte, effectively seal the gases. Alternate bells carry asbestos cloth diaphragms which efficiently prevent the gases mixing, a danger that is further obviated by the provision of a sealed tube on each gas serving to release the gas to atmosphere should the liquid level in the cell drop to such an extent that the diaphragms become uncovered

The ordinary electrode consists of an iron plate to which are welded the pure iron leads, the oxygen-producing electrode or anode being nickel-plated. Of recent times Knowles has introduced a special electrode designed to be interchangeable with the ordinary electrode. This electrode is composed of a number of strips of iron attached to heavy bars, so arranged as to form a hollow electrode with slots at intervals in its depth to assist the electrolyte circulation and avoid gas-screening effects. As the hollow electrode construction reduces the distance between adjacent electrodes, the voltage drop is decreased and the cell voltage is lowered. The efficiency of a cell being defined as the electrical energy required per unit volume of gas, usually hydrogen, produced, this means a reduction in operating cost. By equipping this hollow electrode with copper conductors in place of iron, Knowles has been able to double the capacity of the electrode for a very slight increase in cell voltage, thus reducing the floor space required by the cells.

Illustrating the foregoing remarks, a Knowles cell, fitted with ordinary electrodes and operating at the normal conditions of current, electrolyte quality, and temperature, would require an impressed voltage of 2.125 volts, and would produce hydrogen for a consumption of electricity of 132 kWh

per 1000 cu. ft. The same cell fitted with special electrodes under similar conditions would require only 2 volts and the electricity consumption would drop to 124 kWh per 1000 cu. ft. Alternatively, the current can be doubled, thus doubling the gas output, for the slightly increased voltage of 2.3 volts per cell and energy consumption of 142 kWh per 1000 cu. ft. This interesting development has already had considerable success where increased production from old plant has been required.

The gases pass from the bells into their respective collecting mains which are arranged to form an integral part of the cell, the complete unit so formed being immersed in the electrolyte contained in a tank which is fitted with coils for temperature control. All the cells making up a battery are carefully insulated from ground and each other. The illustration shows a small installation of 22 1000-amp. capacity cells producing 354 cu. ft. of hydrogen and 177 cu. ft. of oxygen hourly and absorbing 47 kWh.

Regarding the employment of the gases, the synthetic ammonia industry utilises the very large installations, as it is generally possible to build factories close to sources of cheap power such as hydro-electric stations. Otherwise, the oil-hardening industry for food and soap manufacture employs fairly considerable quantities of hydrogen, and it is frequently possible to dispose of the oxygen for metal welding and cutting. Hydrogen is also extensively used in hydrogenation processes producing solvents from tar distillates and their derivatives, for balloon inflation, for the preparation of catalysts, for the manufacture of synthetic precious stones for instrument jewels, with oxygen for lead burning, and in the atomic hydrogen welding process. More recently, however, the smaller plants are becoming increasingly popular, especially as powder metallurgy is developing such a demand for pure hydrogen. Wherever pure gases are required, and in this respect Knowles plants which deliver hydrogen of 100 per cent. and oxygen of 99.7 per cent. purity are in the forefront, the electrolytic method is considerably cheaper and simpler, and perhaps most of all, consistent.

Anti-Corrosion Pumps

Selecting Alloys for the Chemical Industry

by H. SEYMOUR

WHILE it has been a comparatively simple matter to design much of the straightforward plant used in the chemical industries, such as pipes and tanks, of the many anti-corrosive materials now offered to the chemical-plant constructor, the making of fairly intricate plant such as centrifugal pumps is quite a different matter.

Corrosion-resisting alloy steels from which a number of very successful centrifugal pumps are made, usually consist of nickel, chromium, silicon, molybdenum, and other elements in varying proportions, the balance being iron. Such alloy steels are very successfully produced in electric furnaces, which make control of the carbon content practical. One of these is a high nickel-chromium-silicon steel which is resistant to sulphuric acid at most concentrations and temperatures This alloy is particularly suitable for 10 per cent. sulphuric acid containing ferric sulphate, such as is found in pickling solutions. For handling food products, alloy of 18 per cent. chromium and 8 per cent. nickel, with small percentages of silicon and manganese, is useful. A similar alloy has almost identical analysis, but contains from two to four per cent. of molybdenum. This is used for handling hot sulphite liquors in the pulp industry and also for phosphoric acid. When used for centrifugal pumps all parts coming into contact with the liquid are made of one or other of these alloys, and the particular type used is chosen according to the corrosive fluid which has to be handled. The pumps are made in both standard and self-priming types, and are suitable for rough usage.

Another alloy contains some 20 per cent. of Monel metal, and is claimed to offer the mechanical qualities of toughened grey cast iron combined with the corrosion resistance of high-grade brass at a substantially lower price than the brass. This alloy can be cut with the same tools at similar speeds and feeds as normal cast iron. A pump of normal construction was recently tried out at a chemical works. This pump was fitted with a 20 per cent. Monel bottom casting comprising the water end and valve boxes. The pump bucket and liner were of the same alloy, as also were the valve seats and pump rings, while the pump rod and valves were of Monel. This pump was put to work on a liquor composed of molasses, yeast, and water with about one per cent. of sulphuric acid. It worked for three days continuously, day and night, and then stood idle for the rest of the week. After three months' service it was found to be in perfect condition.

Some iron-silicon alloys are produced in castings, the composition being balanced so as to produce a metal with the maximum acid-resisting qualities combined with reasonable transverse strength and resistance to shock. These alloys are used for

the construction of pumps of various sizes, and their extreme hardness is an advantage where erosion has to be dealt with. The pump impellers are radically changed in design with the object of making it possible, by slight variations, to secure different capacities and heads in the same casing without sacrificing efficiency. The pumps have a double suction, thrust bearings being avoided. The impellers are carefully balanced and are of the open type, so that solids in suspension can be handled. When the pump is working any tendency towards leakage at the stuffing-box is prevented by the stuffing-box impeller. This is cast integral with the impeller sleeve and forces all liquid away from the stuffing-box and into the pump suction. The pump volute is so designed that, by the loosening of a single clamp, it may be turned at almost any angle, and thus the pump can be adjusted to nearly any conditions of suction and discharge lines, while maintaining the relative position of 90 degrees between suction and discharge.

Centrifugal pumps in which the wearing parts are few, employing a high silicon iron, are in use. The pump casing is of volute form and is provided with an end suction cover, the volute being proportioned to transfer the velocity energy imparted by the impeller into pressure head with the minimum loss. Both the pump casing and suction cover are made in this metal. The pump shaft is of high nickel chromium acid-resisting steel. These pumps are usually supplied complete with a direct-connected motor and starter. Of the non-ferrous alloys Monel metal is used for pump parts which come into contact with corrosive fluids in the chemical and textile industries. A copper-base alloy is in fairly extensive use in American chemical industries as a metal for centrifugal acid pumps. Another is an aluminium bronze consisting of 87.5 per cent. copper, 7.5 per cent. aluminium, 3.5 per cent. iron, the remainder being manganese. This alloy is used for pumps handling sulphurous and hydrofluoric acids.

Stoneware Pumps

Stoneware is also employed for centrifugal pump construction, and in one design the stoneware parts are protected by cast iron armouring to ensure strength. A feature of this design is the use of a liquid between the gland packing. Water is usually recommended and the function of the liquid is to keep the impeller shaft cool, to seal the gland against the escape of gas, and to keep the packing material moist. Such pumps are used successfully for handling acids and alkalis in the chemical, paper, textile, and dyeing industries. Some special pumps for handling corrosive fluids and abrasive materials have as their principal feature a rubber-coated impeller, having flexible vanes formed from a pliant rubber. Pumps for handling abrasive materials and thick pulps are also lined with a soft rubber, and a feature is that all wearing parts can be changed in fifteen minutes. Most of the rubber linings for pumps are of simple form and very easily renewed, though recently some research workers have shown interest in the anode process of electrodeposition of rubber from latex or other aqueous rubber dispersions. This permits laying down uniform coatings of soft, semi-hard, and hard rubber compositions upon articles of intricate shape by a single simple operation.

Waterproofing with Soap

New American Methods

AN improved version of the standard method of employing the properties of soap in the waterproofing of textiles by forming an aluminium soap in the fibres is now being used in America to waterproof tents, according to the *American Dyestuff Reporter* (*30*, 621). The cloth is first treated with a boiling 5 per cent soap solution and then, at room temperature, with a solution of basic aluminium formate, containing 1 per cent. aluminium oxide. Aluminium acetate may be used instead, and, if desired, waxes may be emulsified in the soap solution to enhance the waterproofing. A recent variant for waterproofing woollen articles calls for a preliminary treatment with an oxygen-yielding compound, such as hydrogen peroxide, and then successive impregnations with aluminium acetate emulsion and a soap-wax emulsion.

An American inventor is recorded in *Silk and Rayon* (*16*, 758) as having avoided the use of aluminium salts in a valuable new process, making use of the ability of soap to react chemically with proteins. The textile should first be impregnated with a dilute solution of a protein, of the albumen or globulin type, until the fabric has taken up about four-fifths its weight in protein. The protein is then coagulated (denatured) by moist heat. The waterproofing is completed by boiling, or almost boiling, with an aqueous solution of soap and free fatty acid. The latter may easily be prepared by dissolving the soap in hot water and adding a small amount of acetic acid. This treatment will resist laundering and dry cleaning.

In another permanent waterproofing method widely used for the processing of cotton cloth, the fabric is immersed in an emulsion of dioctadecyl carbonate in water and benzene. The emulsion is maintained by the addition of soap to the mixture. The cloth is then mangled, dried, and heated to decompose the carbonate and to bring about a firm combination of hydrocarbon and cellulose.

Personal Notes

MR. J. S. HUTCHINSON has been appointed a director of Metal Industries, Ltd.

MR. S. K. THORNLEY was re-elected president of the National Paint Federation at the recent annual general meeting.

MR. A. P. MIERAS, chairman of the Edinburgh Section of the Society of Chemical Industry, has been appointed to fill the vacancy on the Finance Committee.

In recognition of his distinguished services as Rector of the Imperial College of Science and Technology, 1929 to 1942, SIR HENRY TIZARD, President of Magdalen College, Oxford, has been elected to an Imperial College fellowship.

MR. PHILIP MORGAN, permanent contractor at the Mond Nickel Works, Clydach, South Wales, who is retiring after 42 years' service, was last week the recipient of presentations from the directors and staff of the company. The presentations were made by Mr. D. Owen Evans, M.P., delegate director.

Obituary

MR. GEORGE PETERS MELVILLE, production supervisor of the Burmah Oil Company, died at Blairgowrie on December 1.

MR. JAMES DICKSON HAMILTON, who died in Edinburgh on November 30, was well-known in the chemical trade in the city through his association with J. M. Bannerman & Co., Grange Road, Edinburgh.

DR. ERIC STYLES, whose death while in the course of his official duties has been reported, was among the most brilliant of the younger scientists emanating from the Imperial College of Science. Only 36 years old at the time of his death, he took the Ph.D. degree at the age of 23. He had recently been in charge of the branch dealing with non-metallic minerals at the Aeronautical Inspection Department of the Ministry of Aircraft Production.

MR. JAMES CRAWFORD, a retired dyestuff and chemical merchant, has died in Glasgow. In business he was a partner in David Crawford & Co., Glasgow, a firm which went out of existence in 1936, and he was also associated with the firm of F. A. Brassard and Crawford, Wakefield, in the manufacture of aniline dyes. Mr. Crawford was instrumental in establishing the Scottish branch of the Society of Dyers and Colourists, acting as secretary for eight years and serving a period as chairman. He was also past-president of the parent body in Bradford.

MR. HENRY JEFFRIES POOLEY, M.Inst.Chem.E., died at his home in Finchley, London, N.3, on December 2, aged 65. There can be few members of the chemical industry in this country—and not many in other parts of the world—to whom Pooley was not a well-known figure. As General Secretary of the Society of Chemical Industry for thirteen years and more, he had been, as Dr. Cullen said in his presidential address at this year's annual general meeting of the S.C.I., "an admirable ambassador" for the society. He knew everybody and everybody knew him, and visitors to Clifton House will feel a pang of regret at knowing that the familiar figure can no longer be there to aid them with a rich supply of ready information and unstinted aid. It is, in fact, some time since Pooley has been seated at his accustomed desk, as ill-health has kept him from his post for many months, though until recently there was always the hope that he might soon be fit enough to get once more into harness. It may well have been that the tremendous effort of transferring the Society's offices from their twice-bombed headquarters and of re-transferring them back again was too great a strain for any one man to bear, especially a man in no very robust state of health. Pooley was already experienced in the administration of a scientific society when he came to the S.C.I. in 1929, as he had already served as honorary treasurer of the Chemical Engineering Group of the society in 1926-27 and as honorary secretary in 1927-29.

Mr. Henry Jeffries Pooley

In his earlier business career, H. J. Pooley joined George Scott & Son (London), Ltd., in 1898, and was attached to the Liverpool office until 1903 when he came to London. He became secretary and director in 1905, and director of the associated company of Ernest Scott & Co., Ltd. He was joint managing director of both firms from 1915 to 1923, when he left to start up as a consultant. He took full share in the great developments of chemical engineering in the early part of the century, and was very thorough and conscientious in all he undertook, both in business or in his "official" career. Though retiring in manner, he never shirked responsibility, and he held the esteem and affection of his colleagues and staff.

Among the large and representative assembly at the funeral service, which was held last Monday at St. Mary's, Finchley, were many members of the family; also Mr. S. E. Carr, representing the Chemical Society; Mr. R. B. Pilcher, representing the Institute of Chemistry; Mr. T. F. Burton, representing Lord Leverhulme; Dr. Hughes, representing Dr. Lampitt and the Society of Public Analysts; Mr. C. S. Garland, President of the Institution of Chemical Engineers; Dr. H. E. Cox, Chairman of the Food Group; Mr. J. S. Jackson, Chairman of the Road & Building Materials Group, representing the Asiatic Petroleum Company, Ltd.; Mr. A. Lowe, representing Mr. H. V. Potter and Bakelite, Ltd.; Mr. L. R. B. Pearce; Mr. G. W. Riley, representing Mr. James MacGregor, of George Scott & Son (London), Ltd.; Dr. William Cullen, President of the Society of Chemical Industry.

New Control Orders

Gelatine Products

The prohibition of the manufacture of gelatine products except under licence takes effect on December 31, but such products may continue to be sold until March 31, 1943. This interval will provide time within which the wholesale and retail trades can dispose of their stocks. For the purposes of the Order, " gelatine product " includes any product containing gelatine, isinglass, or agar-agar, and one or more of the following: sugar, glucose, saccharin or any other sweetening agent, starch, citric acid, tartaric acid, flavouring, gum, arrowroot, or flour or any other cereal product. Returns which manufacturers have to make under the Manufactured and Pre-Packed Foods (Control) Order will be treated as applications for licences under this Order.

Polishes

The Limitation of Supplies (Polishes) Order, 1942 (S. R. & O. 1942, No. 2431) extends the existing Heating Apparatus and Polishes Order for a further period of six months from December 1. The provisions of the existing Order will be repeated subject to the amendments that: (1) there will be two separate Orders, one dealing with space-heating apparatus and the other with polishes; (2) the rate at which polishes may be supplied will be 50 per cent. of supplies during the standard period instead of the present 60 per cent.

Steel Scrap Prices

The Minister of Supply has made the Control of Iron and Steel (No. 27) (Scrap) Order, 1942. The Order came into force on December 10 and fixes maximum prices for the following classes of alloy steel scrap not previously separately covered (in all cases, free from other alloys): Manganese molybdenum heavy steel scrap and short heavy shovellable turnings; carbon chrome heavy steel scrap and short heavy shovellable turnings; chrome molybdenum heavy steel scrap and short heavy shovellable turnings containing not more than 0.5 per cent. nickel (S. R. & O. 1942, No. 2493).

Parliamentary Topics

Concentration of Industry

IN the House of Commons last week, Sir Smedley Crooke asked the President of the Board of Trade whether he was aware of the alarm of small manufacturing firms occasioned by the proposals of his Department under the concentration of industries; and whether he would consider the advisability of setting up appeal tribunals to consider the claims of small firms. Mr. Dalton replied that while small firms—those employing 20 people or less—were encouraged to join in schemes under the concentration of industry policy they were not compelled to do so, unless the scarcity of the raw material available made a strict control of the whole industry necessary. He did not consider that the appointment of appeal tribunals was desirable or necessary.

Bagassosis

Dr. Morgan asked the Home Secretary whether medical officers of his Department were investigating an industrial lung disease, described as bagassosis, caused by the inhalation of dust from cane fibre or bagasse, and whether it was being considered as one of those suitable for inclusion in a general scheme of industrial lung diseases eligible for workmen's compensation. Mr. Morrison replied that he had received reports on this condition from medical inspectors of factories, and understood that it was being specially investigated by the Medical Research Council. Inquiries so far made suggested that the condition was not of such a character as to make it suitable for inclusion in a scheme of compensation on the lines of the schemes for silicosis.

Scientific Advisers

Sir E. Graham-Little asked for the names of the members of the scientific advisers' division of the Ministry of Food, and the members of the Scientific Committee on Food Policy. In reply, Mr. Mabane said that the names of the members of the Scientific Advisers' staff were Dr. J. C. Drummond, Dr. T. Moran, Dr. J. Barker, Dr. C. S. Hanes, Dr. M. Pyke, Dr. S. H. Edgar, Mr. L. G. Barton, Dr. L. Pace, and Dr. A. P. Platt; and that those of the Scientific Committee on Food Policy were Sir Henry Dale (chairman), Professor A. W. Ashby, Professor E. P. Cathcart, Mr. Henry Clay, Professor F. L. Engledow, Sir W. Gavin, Sir Edward Mellanby, Sir John Boyd Orr, Professor J. A. Scott-Watson, and Professor D. M. S. Watson.

General News——From Week to Week

A licence for treating, using, or dealing in mica, employed in the manufacture of munitions and electrical equipment, will be required from December 16.

In these times of paper shortage a diary is particularly welcome, and we should like to congratulate Messrs. W. J. Bush and Co., Ltd., of Ash Grove, London, E.8, on the excellence of the production of theirs for 1943, at the same time offering our thanks for a most handy work of reference.

Since the outbreak of war the work of the chemical laboratory of the B.C.I.R.A. has more than doubled, the microscopic laboratory nearly doubled, the mechanical testing laboratory nearly trebled, and the sands and refractory laboratory increased by half as much again, according to the Association's annual report.

Sir Stafford Cripps, Minister of Aircraft Production, talked with Professor J. B. S. Haldane and Sir Robert Watson Watt, President of the A.S.W., before a meeting of the Association of Scientific Workers held recently at his Ministry. Sir Robert, who presided at the meeting, emphasised the part that scientists could play on joint production committees.

The merits of slag houses were recited to M.P.'s in London last week by Councillor H. Weston, of Coventry, in the course of an inquiry into official obstacles to the building of such houses. Coventry has 400 houses built of blast-furnace slag, and the advocates of further constructions of this type claim that a house of the kind can be built in 24 hours, and that fire-bombs that fell on them "simply fizzled out."

Forty-one thousand employers in England and Wales are now offering facilities for their workers, numbering approximately 6,000,000, to make collective contributions to the Red Cross Penny-a-Week Fund. Thanks to their ready co-operation, the Red Cross and St. John is receiving an income of nearly £30,000 a week from this source. In addition, house to house collections bring in an additional £20,000 a week.

The presence of phosphorus in a new type of explosive bullet used by the Germans has been confirmed by Lieut. K. M. Wheeler, R.E. His investigations were initiated as a result of an operation performed by Dr. A. J. Blaxland, senior surgeon of the Norfolk and Norwich hospital, on a wounded airman, who landed near Norwich. It was noted that the wound, during an operation, emitted a visible vapour which was found to possess the characteristic smell of phosphorus. Examination of similar bullets from a wrecked German plane revealed a charge of high explosive, plus 3¼ grammes of phosphorus.

Eight M.P.'s, headed by Major Braithwaite and Sir Frank Sanderson, have tabled a motion urging the Government to begin production of synthetic rubber.

The following Fellows have been elected by the Board of the Institute of Physics: J. D. Bernal, M.A., K. G. Emeléus, M.A., Ph.D., G. Liebmann, D.Phil., and W. E. M. Romer, Dr.Tech.Sci.

At the I.C.I. Billingham Works recently a fitter's labourer was fatally injured by falling from the top of a boiler. It is said that the fall was caused by his catching a loose boot-sole on a spanner—one more death due to the dangerous practice of using clothing which is in need of repair.

The remarkable way in which the trade and periodical Press has managed to adapt itself to working with one-fifth of the paper it used in pre-war times is demonstrated at the exhibition "Design for Economy—Paper in Battledress," now on view at the Ford Showrooms, Regent Street, W.1.

Foreign News

Chlorine and phenol in Canada may soon be placed under the allocation of the chemical controller.

The War Production Board, Washington, has set up an antimony-tungsten-molybdenum branch and a tin-lead branch.

Argentina has created an egg-drying industry to utilise the surplus created when the U.K. cut off shell-egg imports because of shipping conditions.

A factory for the production of mercury with a capacity of some 60 kg. per day has been built at Zlatna, Rumania. The extraction will be performed on modern lines and will yield 4 kg. per ton of ore.

Schneider-Creusot, the French armament concern, has acquired the controlling interest in Etablissements Barbet, manufacturers of chemical apparatus and operators of distillation plants.

Manufacture of soap as a war-time measure is being encouraged as a cottage industry in the Gambia. Simple instructions have been drawn up and the Government issues caustic soda to approved applicants.

Drastic reduction of imports of certain insecticide chemicals into the U.S. has led Du Pont chemists to devise a combination of castor oil and pyrethum for fly sprays. The new product is called IN-930, and was accepted after 929 rejects.

Discovery of a valuable source of tungsten in the Yukon territory has been reported by Dr. H. V. Warren, University of British Columbia. He claims that British Columbia will soon produce as much tungsten in a week as it did in its whole history before the war.

An explosion at the Baelenwezel chemical works, near Antwerp, is reported to have caused 50 deaths. The explosion is attributed to overheating during a chemical process.

Discussing chrome deliveries from Turkey, the *B.Z. am Mittag* recently expressed the pious hope that in 1943 Turkey will probably export 108,000 tons of chrome ore to Germany.

"**Complete success** in finding substitutes for copper, lead, and zinc" on the part of German industry is claimed by a writer in the *Militär Wochenblatt*, according to a report from a correspondent of *The Times* "on the German frontier."

Use of cocoa butter as cooking fat and of cocoa for making cocoa soap is being popularised in the Gold Coast as part of the Government's scheme to solve import and export problems, and to use up surplus cocoa crops in the Colony.

Encouraging news of U.S. manganese output comes from W.P.B., Washington, which reports that remarkable success has been registered in the 1942 development campaign, with the prospect of still more encouraging results in 1943.

The Pasteur Institute is reported to have on hand plans for making oil from apple pips of from 19 to 23 per cent. fat content. It is estimated that France can produce 11,000 tons of this oil which will be especially needed now that oil exports from North Africa have ceased.

The lead mines near Apiahy, S. Paulo, Brazil, are to be intensively worked, and steps are to be taken to extract other minerals which are abundant in the Ribeira valley. It is understood also that a special mission from the U.S.A. is to study the possibilities of the manufacture of aluminium in Brazil.

Experiments were begun in French Guinea in 1940 to convert bananas into alcohol, when their exportation became increasingly difficult. After a number of attempts, the problem, according to trade reports, has now been solved, but the process is regarded as an emergency expedient, and not as an economic proposition.

Blows levelled at the Nazi chemical industry by the R.A.F. continue to be heavy and well-directed. Recently released photographs show bomb-bursts on the Royal Dutch blast-furnace and steelworks at Velsen, near Ymuiden, where the coke-oven plant and benzol by-product plant appear to have suffered heavily.

A new oil container, described as a "tinless" oilcan, has been introduced in the United States. The new container is of plastic and fibre construction and is claimed to be leak-proof and impervious to oil. The new container was developed by Albert A. Robbins, consulting chemist of the Macmillan organisation, Pittsburgh.

Forthcoming Events

At the next meeting of the London section of the **Institution of the Rubber Industry,** to be held at the Caxton Hall, Caxton Street, S.W.1, at 6 p.m., on **December 14,** there will be a symposium on "Uses and Manufacture of Oil and Thermal Reclaim."

The Structural and Building Engineering Division of the **Institution of Civil Engineers** will meet at 2 p.m., on **December 15,** when Dr. F. M. Lea will speak on "Modern Developments in Cement in Relation to Concrete Practice."

A lecture on "Modern Development in the Plastics Industry" will be given by Mr. M. D. Curwen, B.Sc., A.I.C., at a meeting of the **Institution of the Rubber Industry,** at the Grand Hotel, Leicester, at 1 p.m., on **December 15.**

The third of the Royal Institution's lectures on "The History of Our More Important Foods," by Professor J. C. Drummond, D.Sc., F.I.C., is entitled "Fruits and Vegetables." It will take place at the **Royal Institution,** Albemarle Street, W.1, at 3 p.m., on **December 15.**

The annual general meeting of the **British Cast Iron Research Association** will be held on **December 16,** at Alvechurch, Birmingham.

The Chemical Society's Tilden Lecture entitled "Recent Developments in the Theory of Reaction Kinetics in Solution" will be given by Mr. R. P. Bell, M.A., B.Sc., at Burlington House, Piccadilly, London, at 2.30 p.m., on **December 17.**

A meeting of the **Royal Institution of Great Britain** will be held, at 5 p.m., on **December 18,** at the Royal Institution, Albemarle Street, W.1, when Dr. J. W. Munro will speak on "The Place of Research in the Control of Injurious Insects."

British Chemical Prices

Market Reports

CONDITIONS throughout the industrial chemicals market during the past week have been firm, and a steady movement into consumption has been maintained for most items in regular demand. So far as fresh business is concerned there has been a moderate flow of inquiry, but actual bookings have been restricted by supply considerations. In the soda products section there is a ready demand for Glauber salt, salt cake and nitrate of soda, while a moderate inquiry is reported for hyposulphite of soda. Chlorate of soda, caustic soda and bichromate of soda are in steady demand. There is little change in the position of the potash products, offers of most items being quickly absorbed, while powdered arsenic is a good market and both

acetone and formaldehyde are firm and a steady demand is reported. A moderate amount of business is being transacted in red and white lead and ready-mixed paints, values for which are well held. No change is reported in the coal-tar products market. Cresylic and carbolic acid and naphthalene continue in good demand and the benzols and toluols remain steady.

MANCHESTER.—Contract deliveries have accounted for the bulk of the business in heavy chemicals on the Manchester market during the past week, though there has been a moderate amount of new inquiry and further additions to order-books. Precipitated barium carbonate has moved up rather substantially and pronounced firmness is a feature of most other sections. Most of the acids are in good demand and a steady trade is being done in the alkalis. The tar products, especially the light materials, are being taken up steadily.

GLASGOW.—In the Scottish heavy chemical trade there has been a slight improvement for home business during the past week. Export trade still remains very restricted. Prices keep very firm.

Price Changes

Barium Carbonate.—MANCHESTER: precipitated (4 ton lots), £16 per ton d/d.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

LANGLEY ALLOYS, LTD., Slough. (M., 12/12/42.) November 18, mortgage, to Barclays Bank, Ltd., securing all moneys due or to become due to the bank; charged on all present and future book and other debts and the full benefit of all the securities for same. *£70,000 floating charge. £3102 mortgages. March 16, 1942.

EVODE CHEMICAL WORKS, LTD. (formerly DOVE CHEMICAL PRODUCTS, Ltd., SPIC & SPAN CHEMICAL PRODUCTS, LTD., and SPIC & SPAN SHOE POLISHES, LTD.), Stafford. (M., 12/12/42.) November 18. £1000 mortgage, to Stafford & County Building Society.; charged on 22 Stone Road, Stafford. *——. May 25, 1940.

BRITISH FILTERS, LTD., Market Harborough. (M., 12/12/42.) November 18, mortgage and charge, to National Provincial Bank, Ltd., securing all moneys due or to become due to the bank; general charge. *——. July 6, 1942.

Satisfactions

PLASTICS & RUBBER MACHINERY CO., LTD., London, W. (M.S., 12/12/42.) Satisfaction November 20, of debenture registered May 15, 1942, to further extent of £1000.

Notice of Dividend

POMROY, DAVID, Osborn Street, London, E.1, manufacturing wholesale chemist, trading as OSBORN TRADING CO. Dividend 6d. per £, payable December 15, Kimberley House, Holborn Viaduct, London.

Chemical and Allied Stocks and Shares

DULL and inactive conditions have continued to rule in Stock Exchange markets, but there was again very little selling, and with few exceptions, movements in values were small. British Funds were subsequently reported to be in larger demand, and the general undertone in industrial securities has become firmer at the time of writing.

Shares of chemical and kindred companies reflected the general tendency. Imperial Chemical at 36s. were within 1½d. of the level ruling a week ago, while the 7 per cent. preference units had a firm appearance at 35s. 3d. B. Laporte remained at 71s. 3d. and on consideration of the full annual report, Imperial Smelting have been firm at 14s. Tube Investments, aided by the results and the strong position shown by the accounts, were quoted at 89s. 6d. On the other hand, Borax Consolidated eased slightly from 34s. 3d. to 34s., although the prevailing market view is that the dividend is likely to be kept on a 7½ per cent. basis. Following their recent rise, Lever & Unilever have reacted from 33s. 9d. to 33s. at the time of writing. British Oxygen went back from 74s. to 73s. 1½d., but British Aluminium at 49s. were unchanged on balance.

Although "ex" the interim dividend, Thomas De La Rue at 80s. were unchanged on balance and have remained active following their recent strong advance; but best prices made in the past few days have not been held. Other shares of companies connected with plastics were well maintained, with British Industrial Plastics 2s. ordinary 4s. 7½d., Lacrinoid Products 4s. 1½d., Erinoid 9s. 4½d., and Catalin 3s. Following their recent improvement, Triplex Glass reacted 1s. to 31s. 3d., and among other shares of glass companies, Key Glassworks and Jackson Bros. (of Knottingley) were firmly held, awaiting the financial results. W. J.

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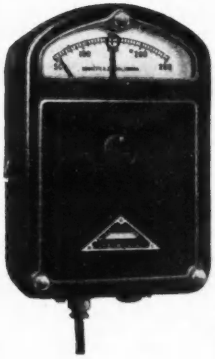

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Bush continued to be quoted at 50s. "middle," while Fisons were steady around 40s. pending the dividend announcement. Business around 16s. 7½d. was shown in British Thermostat 5s. ordinary, at 6s. 3d. in Greeff-Chemicals Holdings 5s. units, at 6s. 9d. in Blythe Colour Works, and at 7s. 4½d. in British Glues. Moreover, Barry & Staines further improved from 37s. to 37s. 6d. while awaiting the results, due early in the new year. Nairn & Greenwich have rallied from 55s. 7½d. to 56s. 3d.

Elsewhere, General Refractories had a firmer appearance at 12s. 1½d., sentiment being influenced by hopes that the great activity in the iron and steel industries will continue to increase demand for the company's products. The units of the Distillers Co. remained firm at 83s. 3d. awaiting declaration of the interim dividend, and United Molasses were steady at 29s. 6d. Further small declines were shown in textile shares, including British Celanese, which were 15s. 9d., and Courtaulds at 44s. 9d. Calico Printers were 12s., and Bradford Dyers 14s. 9d. Only small movements were shown in iron and steel issues; Dorman Long were 22s. 3d., Stewarts & Lloyds 49s. 9d., and United Steel 25s. 9d. Among paint shares, Lewis Berger remained under the influence of the good results, and although "ex" the dividend, were 71s. or virtually the same as a week ago. Pinchin Johnson were 30s., and Indestructible Paint improved to 95s., while Wall Paper Manufacturers deferred units were better at 32s. 9d.

At 17s. 6d. Cellon 5s. shares were again higher. Dunlop Rubber units were steady at 33s. 3d. In other directions, Boots Drug remained firm at 39s., and Timothy Whites, which have been under the influence of satisfaction with the financial results, were 23s. 6d. British Drug Houses remained at 20s., and Sangers 5s. ordinary at 19s. 9d. Allied Ironfounders have been steady at 39s. xd., and Amalgamated Metal were 17s. 10½d. A better tendency developed in

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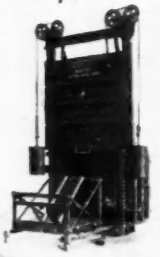

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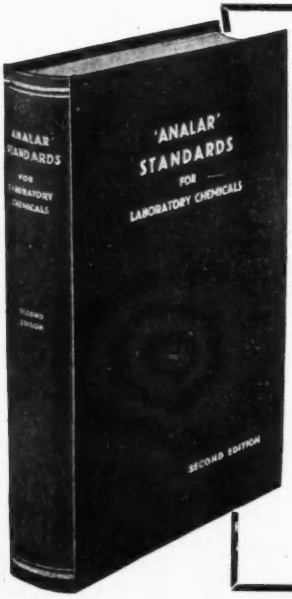

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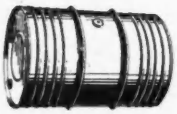

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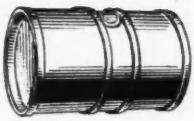

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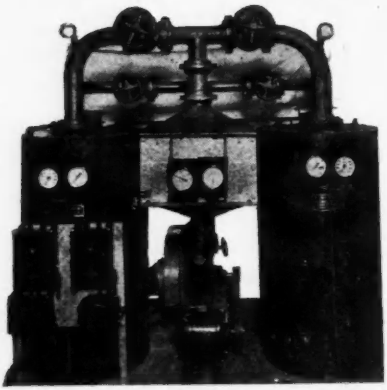

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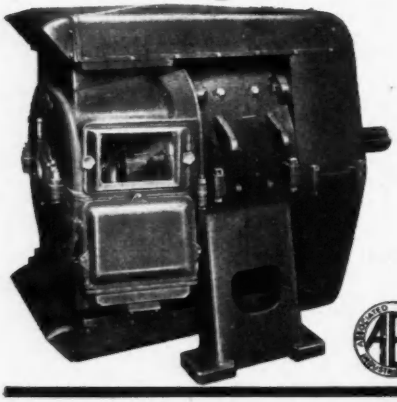

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Printed in Great Britain by THE PRESS AT COOMBELANDS, LTD., London and Addlestone, and published by BENN BROTHERS, LTD., at Bouverie House, 154, Fleet Street, E.C.4., December 12th, 1942. Entered as Second Class Matter at the New York, U.S.A., Post Office.